MACHINERY

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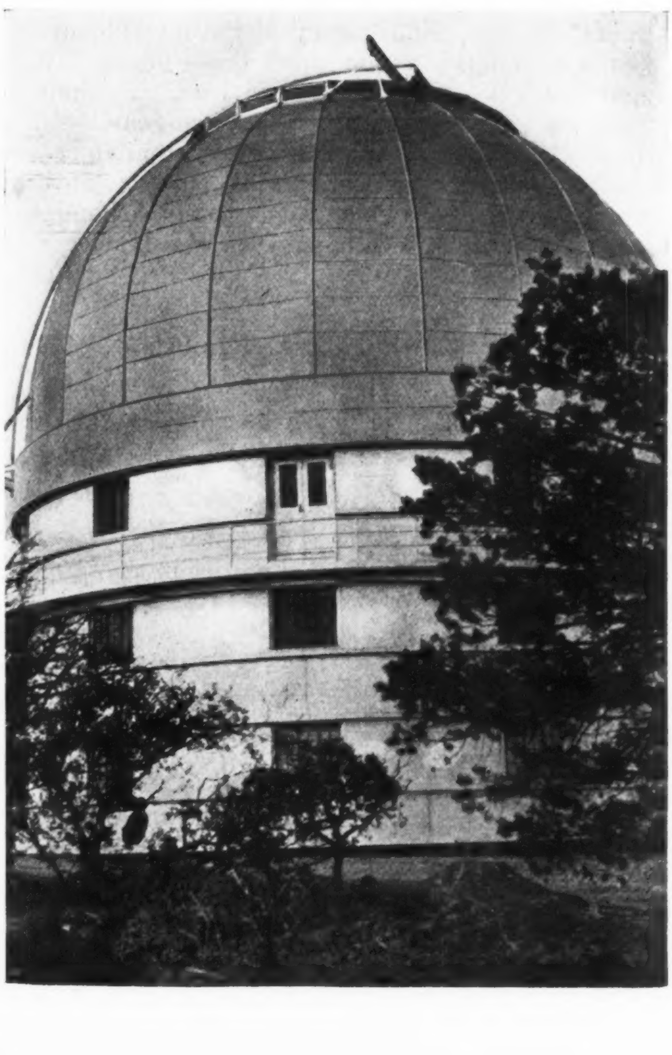
Modern Astronomy Relies on the Machine Shop

By CHARLES O. HERB

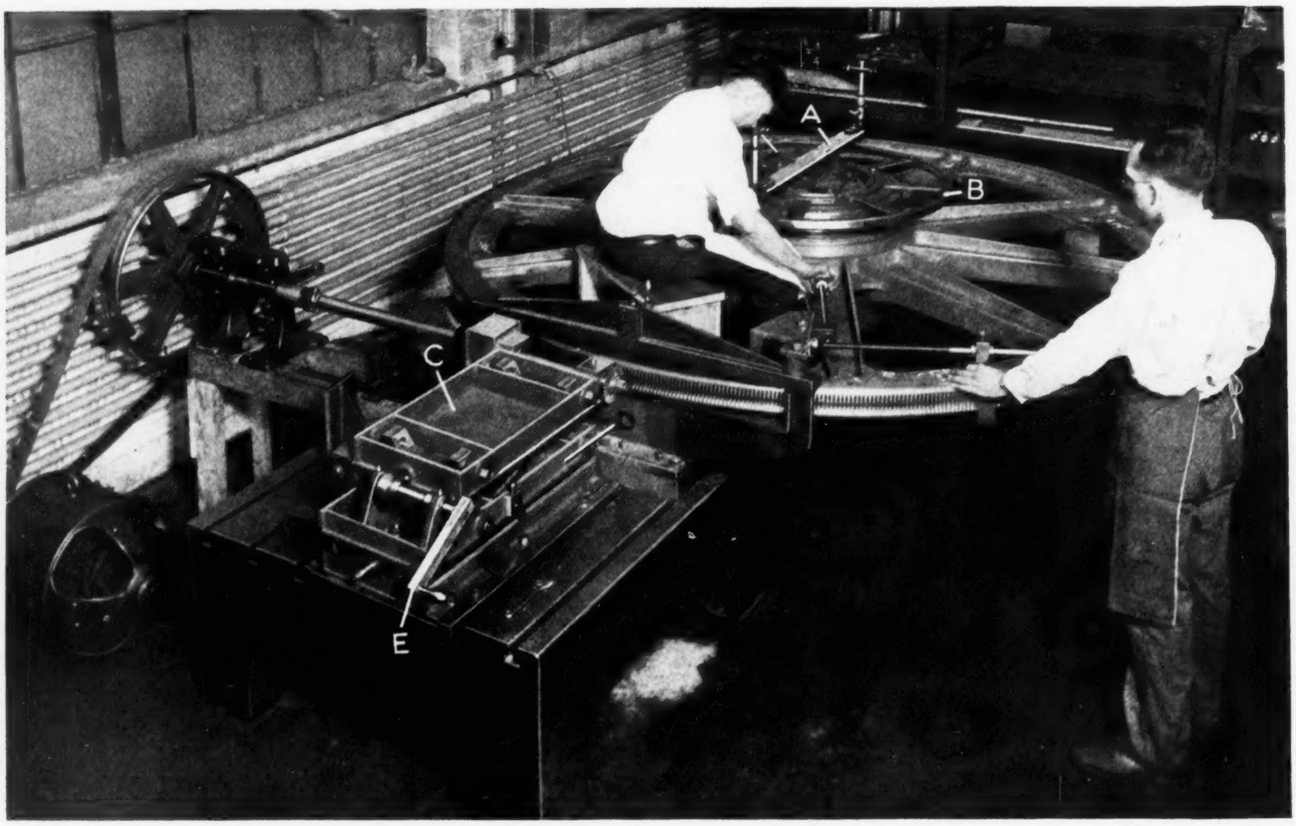
Some of the More Important Machining Operations in Constructing the Huge Telescope for the New McDonald Observatory, Designed and Constructed by The Warner & Swasey Co.



THE optical equipment in an astronomical observatory always excites popular interest, and the interest is heightened when it is realized that years of extremely skillful work are required to produce this equipment. The powerful lenses and mirrors, however, would be of little use without the mechanical means required for focussing them on the planets and stars and for compensating for the rotation of the earth and the movements of the planets. In photographing stars, exposures of from ten to thirty hours must be made without a tremor of the telescope, and the huge instrument must remain trained on the particular star or group of stars all the time the photographic plate is in position. Sometimes an exposure started one night cannot be completed for a week or more, because of rain, clouds, or other unfavorable atmospheric conditions. The design and construction of a telescope, therefore, calls for mathematical precision.

The next to the largest telescope in the world will soon be erected in the new McDonald Observatory which has been built on a mountain top in Texas. This observatory of the University of Texas stands at an elevation of 6800 feet above sea level, forty-three miles from the nearest railway. The telescope is of the reflector type, and is fitted with a mirror 82 inches in diameter by 13 inches in maximum thickness. The weight of the mirror alone is about 5600 pounds, while the telescope itself weighs approximately 50 tons. The telescope tube is 27 feet long without the spectrograph, and 9 feet in outside diameter.

The observatory and its equipment were designed by The Warner & Swasey Co., Cleveland, Ohio, and built either in the shop of that company or under its supervision. This article will describe some of the machining operations performed on the larger parts of the telescope to insure that the instrument will be accurate within one second of arc when installed. Space



will not permit describing the making of the smaller details, such as the timing gears, even though they are of vital importance in the functioning of the telescope. The large parts to be considered in this article were machined by the Wellman Engineering Co., Cleveland, Ohio, except for the cutting of the teeth on two large worm-gears, which was done in the Warner & Swasey shop. The observatory dome was fabricated by the Paterson-Leitch Co., also of Cleveland.

Two worm-gears, 9 feet in diameter and weighing about 1800 pounds each, are required for adjusting and operating the telescope. The teeth of these worm-gears had to be cut to extremely close limits, because the accuracy of the instrument depends to a large extent upon these gears. Each gear has 720 teeth of 3/8-inch lead. Equipment built especially for cutting the worm-gear teeth is illustrated in Fig. 1. It will be seen that the teeth are produced by a form milling cutter. Several roughing cuts were taken completely around the gear, after which a finishing cut was taken.

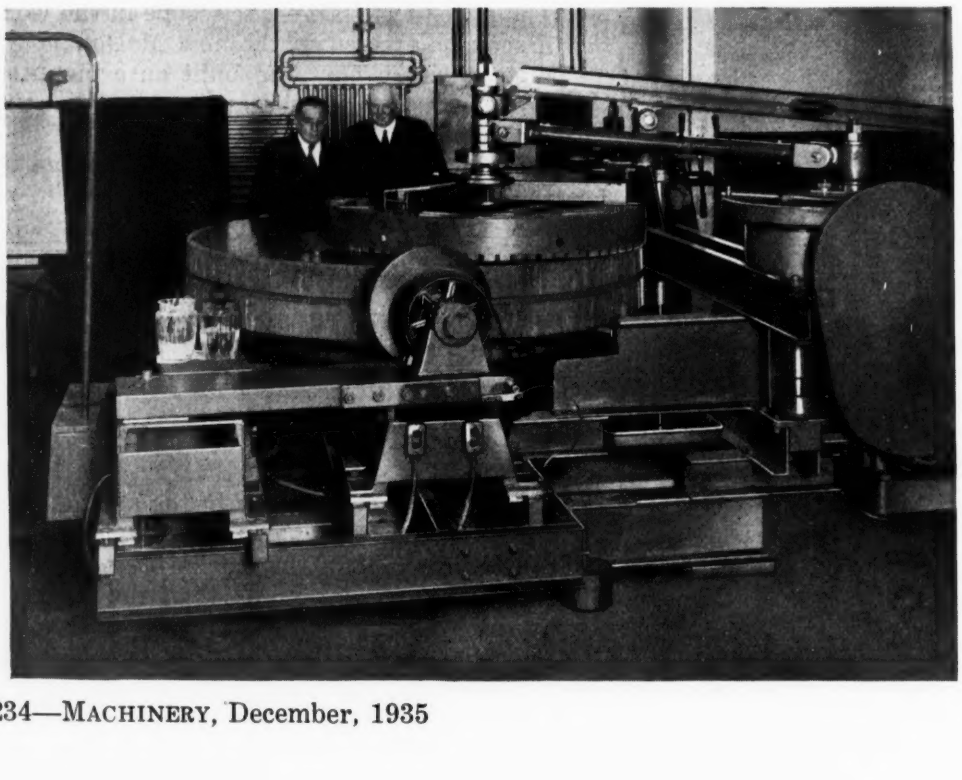
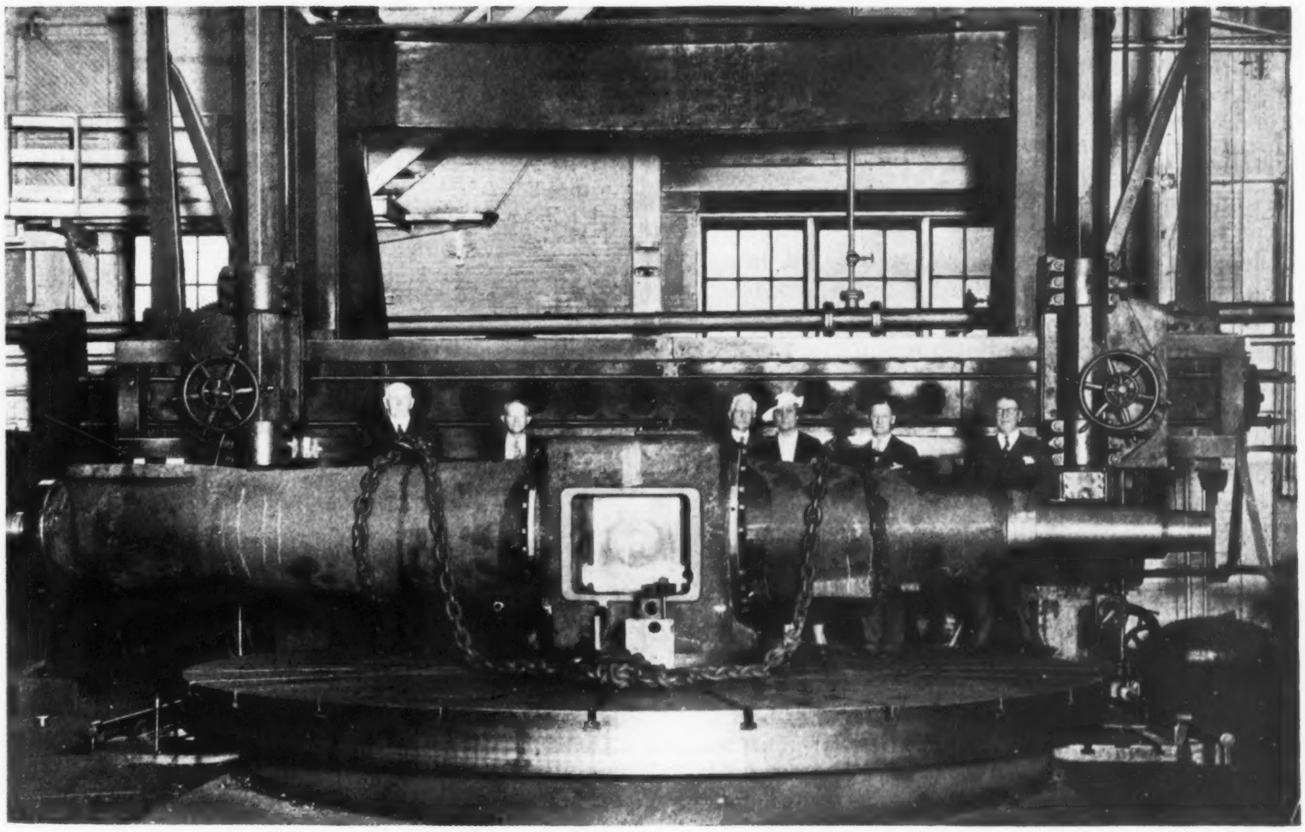


Fig. 1. (Above) Microscopic Precision was Necessary in Cutting Two Large Worm-gears to Meet the Stringent Requirements for Accuracy

Fig. 2. (Left) The Grinding and Lapping of the 82-inch Diameter Mirror is an Operation that will Require Two Years



Accurate indexing for the cutting of each tooth was insured by means of two microscopes mounted on opposite ends of a stationary bar *A*. These microscopes were used to observe graduations on "circle" *B*, which was mounted carefully on the hub of the worm-gear. It is the extreme accuracy found in the graduations on this circle which must be transferred to the teeth of the worm-gear. The very accurate 40-inch dividing engine, designed and constructed by the Warner & Swasey Co. several years ago, is responsible for this extremely accurate circle, which itself is 36 inches in diameter. By means of the graduations of the circle, accurate settings are made for each of the 720 teeth to be ground.

In setting up circle *B* on each worm-gear, concentricity was obtained by observing opposite graduations through the two microscopes, revolving the gear and the ring through 180 degrees, again observing the position of the graduations beneath the two microscopes, and finally making adjustments. After the ring had been accurately

Fig. 3. (Above) The Polar Axis on which the Telescope Proper is Suspended is 24 Feet in Length and Weighs Approximately 25,000 Pounds

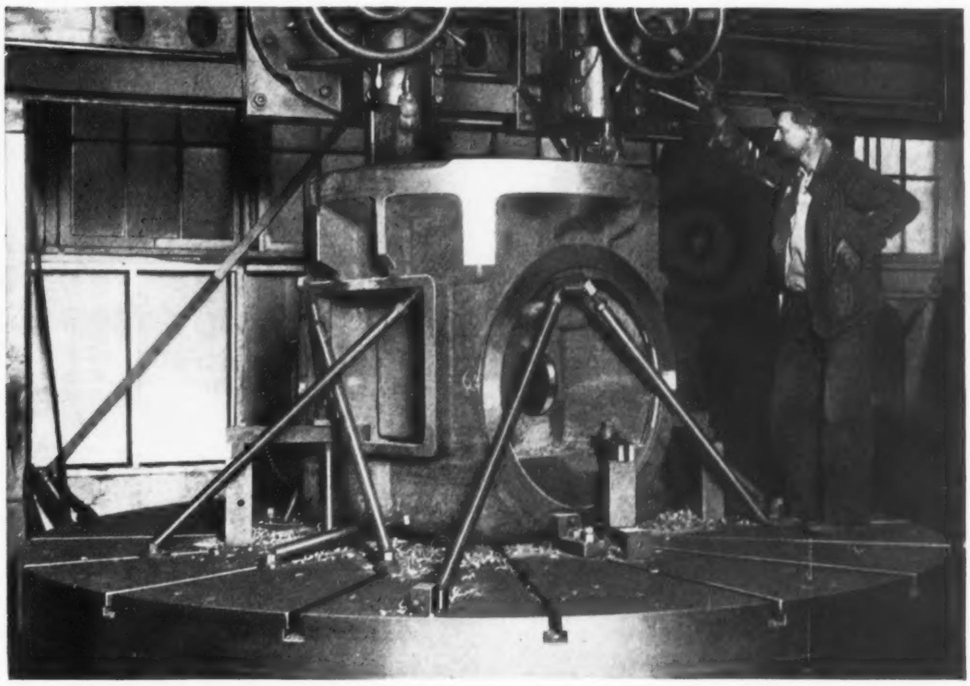


Fig. 4. (Right) Boring the Central Part of the Polar Axis to Receive a Timken Bearing of 52 Inches Outside Diameter

set up, its graduations were carefully observed through the microscopes to insure accurate indexing for cutting each successive gear tooth.

Novel Means Employed to Mount the Cutter

When this gear-cutting equipment was designed, it was decided that accurate feeding of the cutter to the desired depth would be a difficult problem if the cutter were mounted on a conventional slide, due to shifting of the oil film between the bearing surfaces of the slide and its supporting member. The cutter was therefore mounted on a frame *C*, which is supported at the front and rear by horizontal centers fastened to vertical links which are attached to base *D*. This construction obviates long flat bearing surfaces.

The cutter is gradually fed to the required depth in cutting each gear tooth by turning handle *E*, which revolves a cam of the proper throw against the back end of frame *C*. With the rotation of this cam, frame *C* swings forward and backward on its supporting links, springs being provided to keep the frame in contact with the cam.

After a cut was taken on each tooth completely around the gear, the cutter unit was accurately positioned for the next series of cuts by turning a micrometer screw on the table on which base *D* is mounted. The worm-gears are bronze castings.

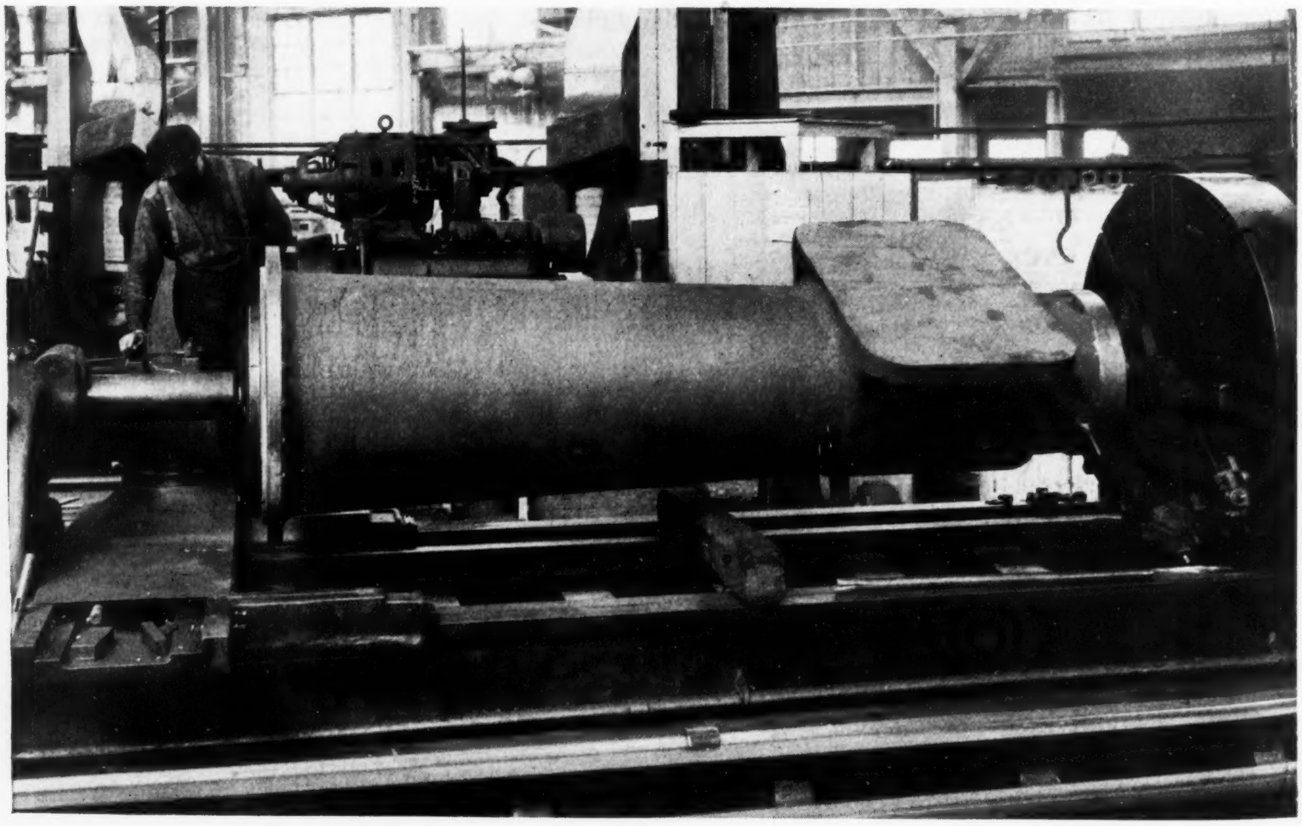
Fig. 5. Turning and Facing One of the Heavy End Members of the Polar Axis

Cast-Iron Laps for Grinding the Mirror Presented a Difficult Problem

The grinding and polishing of the huge glass mirror for this telescope is an operation that will require at least two years, due to the fact that the reflecting surface must be flawless and accurate within a millionth of an inch. A long time is required because the mirror, in its final stage, can be polished for only fifteen minutes a day; and in the process, minute errors in curvature may be uncovered from time to time that must be completely eliminated. The mirror is being ground with the special equipment shown in Fig. 2. Cast-iron laps are used in conjunction with Carborundum of various grains for rough grinding. Three sizes of laps are required—one, 24 inches in diameter; another, 60 inches in diameter; and a third, 82 inches in diameter.

These laps had to be faced to a spherical surface with a radius of 50 feet. How to produce an accurate templet for controlling the sphericity of the laps while they were being machined on a boring mill presented an unusual problem. This problem was finally solved in the following manner: A milling machine was set up about 35 feet from the side of a planer, and an I-beam approximately 50 feet long was pivoted on the milling machine table and attached loosely to the planer table. The I-beam projected across this planer to the table of a second planer, positioned parallel to the first.

The steel plate from which the templet was to be cut was clamped on the table of the second planer, and an oxy-acetylene torch was mounted



on the end of the I-beam directly above the plate. Then, as the table of the first planer was fed along its ways and the second planer table was held stationary, the steel plate was cut out at a radius slightly greater than 50 feet.

The torch was next removed from the end of the I-beam and replaced by a grinding head for finishing the edge of the steel plate exactly 50 feet from the pivoting point on the milling machine table.

In facing the laps, this templet was mounted on top of the boring-mill cross-rail and a shoe was attached to the tool ram which rode on the templet. In this way, the cutter was guided in a convex path of the desired radius while it was fed across the work. Grooves were planed across the faces of the laps at right angles to each other.

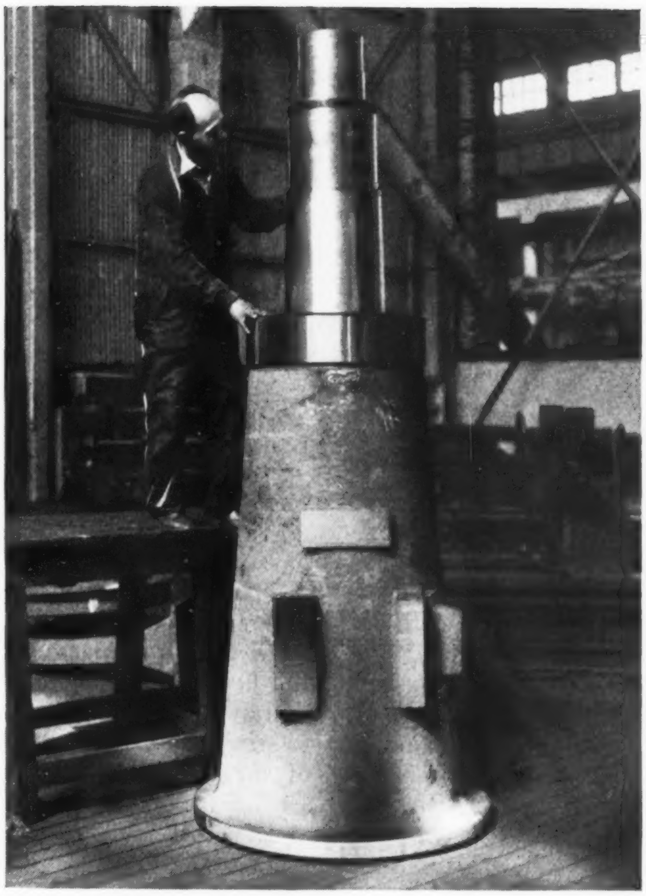


Fig. 6. The Journal on Each End Member of the Polar Axis is Machined from a Steel Forging and is Pressed into the Casting

The machine shown in Fig. 2 was designed to impart any desired motion to the lap. For instance, the lap can be revolved on its own axis, in addition to being moved eccentrically over the mirror. Also, it can be moved automatically around the entire mirror or its motion confined to a particular area.

The 24-Foot Polar Axis Had to be Straight within Extremely Close Limits

The telescope is mounted on an axis that is parallel to the axis on which the earth rotates. The parts that make up this polar axis *A*, Fig. 8, are shown assembled in Fig. 3 on the table of a large boring mill where the axis was placed for checking the straightness. This inspection was accomplished by means of two straightedges, each 1 1/2 by 15 inches in cross-section by 20 feet in length. The straightedges were checked against each other to insure accuracy, only one being used on the job.

In checking the polar-axis assembly, the straightedge was laid across the table at the front of the polar axis and parallel with it. From the straightedge, a height gage was used to check the distance of the journals at the ends of the polar axis. Although the polar axis is approximately 24 feet long and weighs about 25,000 pounds, these measurements had to be true within 0.001 inch.

When the polar axis had been checked as explained, it was turned 180 degrees on the table, and the inspection repeated so as to obtain a double check. To facilitate the inspection, a collar was shrunk on the smaller diameter journal at one end of the unit to correspond with the larger journal diameter at the opposite end.

One of the important requirements in machining the polar axis was to finish the two bolt flanges on the sides of the central member within 0.00033 inch of a true right angle with respect to the large bore in the end seen resting on the table in Fig. 3. This bore is shown being finished in Fig. 4 to receive a Timken tapered roller bearing of 52 inches outside diameter.

The first step in machining this part was to mount it in a lathe for finish-facing the two side flanges; then the casting was set up on a planer, with one of the finished flanges for a locating surface, and the bottom of the casting was planed to obtain a flat surface for the boring operation on the bearing seat. The casting was next set up on the boring mill as shown in Fig. 4 for performing that operation.

In making this set-up, an indicator attached to one of the boring rams was fed downward across the top and bottom portions of one of the bolt flanges, and adjustments were made until the indicator readings were the same at the top and bottom of the flange. Then the casting was revolved through 180 degrees to bring the second bolt flange to the front of the machine, and readings were taken on this flange in the same manner as on the first. Readings and adjustments were repeated until the two flanges were as closely vertical as it was possible to make them.

A lathe operation on one of the end members of the polar axis is illustrated in Fig. 5. An interesting feature of this part is that steel to the extent of 1500 pounds had to be welded to it on one side to provide means of attaching the counterweight. This counterweight when in place weighs approximately 13 tons. The journal provided on this casting and also on the other end casting of the polar axis shown in Fig. 6 are solid forgings, pressed into the castings prior to being turned and ground. The different fits on these journals were held to extremely close limits.

The Telescope Unit that Houses the Optical Equipment is of All-Welded Construction

The telescope proper which houses the large mirror and the other optical equipment is approximately 20 feet long by 9 feet maximum diameter. It is practically of all-welded steel construction. Fig. 7 shows the housing which is attached to the polar axis for supporting the telescope itself. The large mirror is mounted on one end of this housing, as indicated at *B*, Fig. 8.

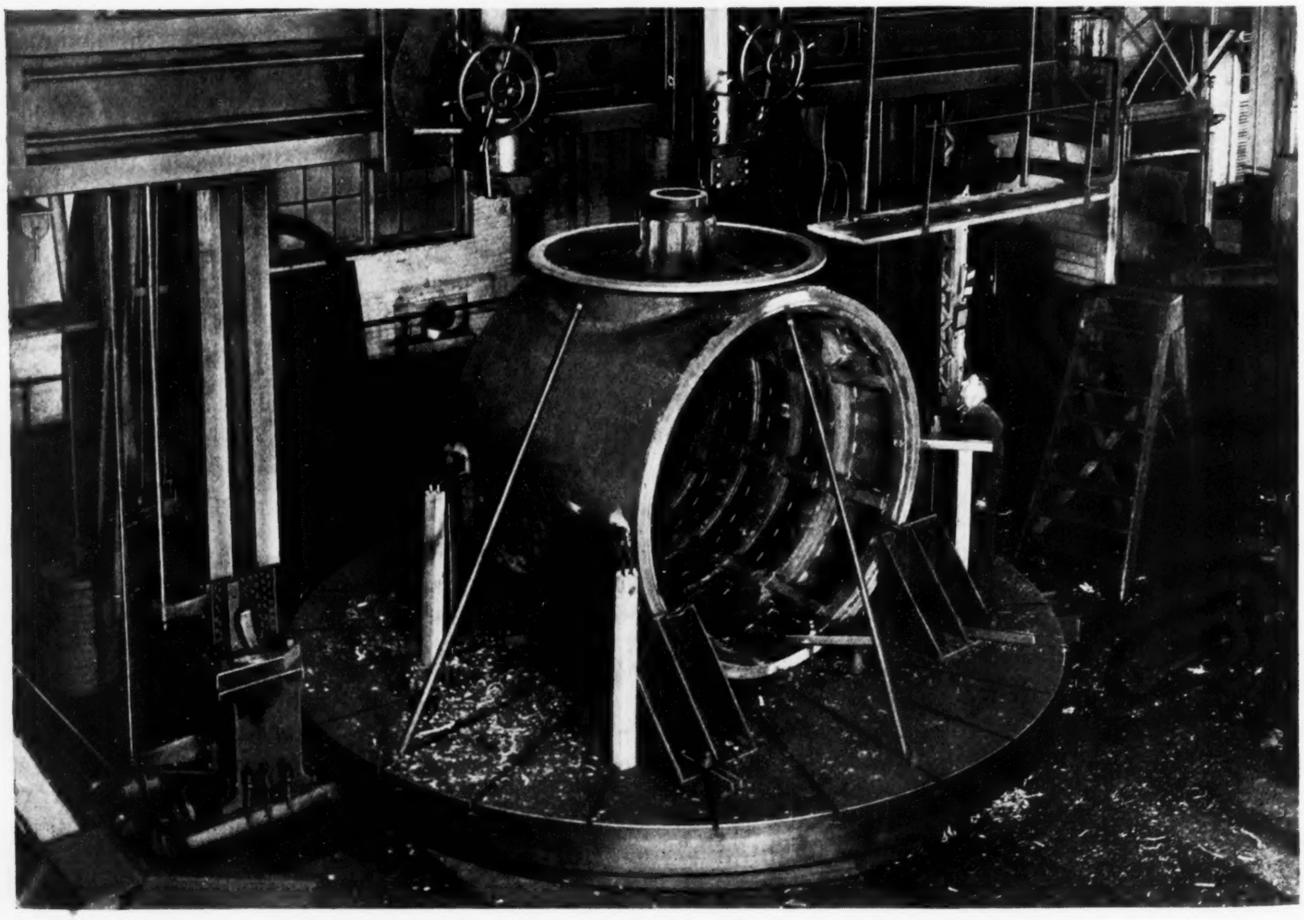
In machining this part, it was important to finish the upper flange at a true right angle with the vertical faces on both ends. This was insured by applying an indicator, attached to one of the rams, to the top and bottom points of each finished end (in the same manner as with the job shown in Fig. 4) until the finished ends were truly vertical. The part was then bored to receive two Timken tapered roller bearings of 54 and 28 5/8 inches outside diameter. The bores for the roller bearings were held to size within plus or minus 0.00033 inch for roundness.

This part is 104 inches outside diameter by about 82 inches high. It was electrically welded from steel varying in thickness from 3/8 inch to 2 inches. The hub is a high-carbon steel forging, 16 inches maximum diameter.

The Telescope and Observatory Dome are Designed for Easy Manipulation

The use of roller bearings and correct counterbalancing have proved so effective that it is possible to manipulate this 50-ton telescope with a 1/4-horsepower motor, although a larger motor will actually be installed for this purpose when the telescope is erected at its permanent site. The use of large roller bearings also made it possible to

Fig. 7. Welded-steel Housing of the Telescope Proper, Set up on a Boring Mill for Accurate Boring, Turning, and Facing Operations



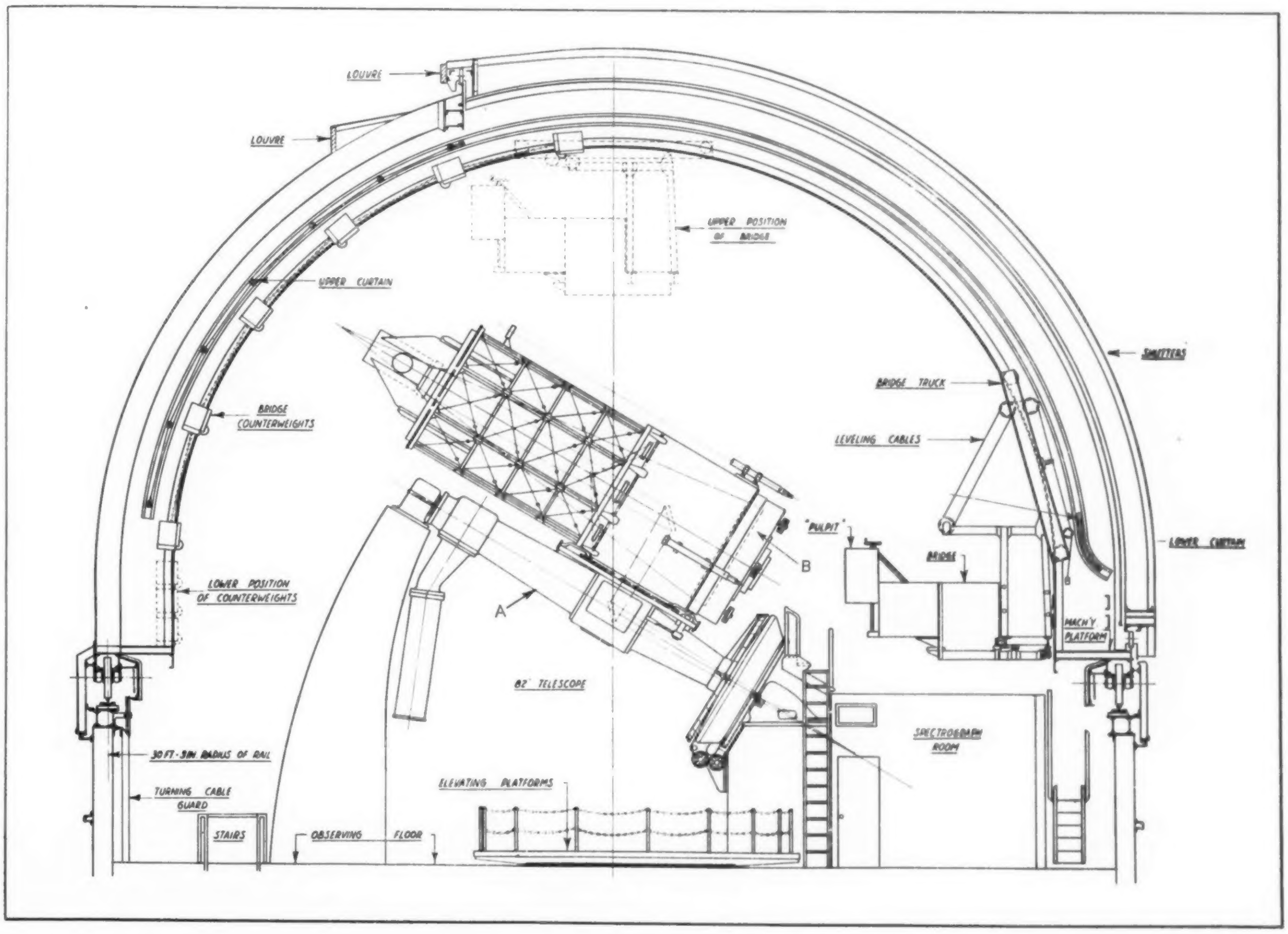


Fig. 8. Diagrammatic Drawing of the McDonald Observatory and its Equipment

employ a cross-axis that is unusually short. The cross-axis is only 2 feet long, even though it supports approximately 13 tons.

The observatory dome, which is 62 feet in diameter by 73 feet high and weighs about 140 tons, is rotated on its circular track by a motor of only 3 1/2 horsepower. This has been made possible by providing the twenty-six wheels on which the dome is supported with roller bearings.

* * *

Non-Porous Protective Coatings for Metal and Non-Metallic Surfaces

As a result of prolonged research at a leading technical institute, a new vehicle or "base" for protective coatings or finishes has been developed which is claimed to be the first material of this kind that is absolutely free from porosity and impervious to water and corrosive atmospheric gases. A line of new coatings made with this base material which can be applied by brushing, spraying, or dipping, after thinning with pure turpentine or high-grade mineral spirits, is being produced by Technical Coatings, Inc., 11 Park Place, New York City.

This material is a combination of pure vegetable gums and heat-treated oils made by a new process. It contains no linseed oil or synthetic resins. It forms films that are air- and water-tight, elastic, and will not peel, chip, or crack. For this reason, it is especially adapted for preventing corrosion of metals. It is also adapted for wood and the surfaces of other materials such as dry concrete and plaster. Its resistance to salt and fresh water and to all degrees of humidity, as well as to extremes of temperatures, is said to be exceptionally high.

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Smoke-Pipe Elbows Made by Quantity-Production Methods

Five hundred smoke-pipe elbows are produced per eight-hour day by two men operating a machine recently developed by the Ingels Elbow Machine Corporation, 2634 W. Fullerton Ave., Chicago, Ill. In performing an operation in this machine, a jig is slipped over a finished piece of pipe. In one revolution of the pipe, a segment is cut out and beaded. The ends of the segment snap together instantaneously, and in another revolution of the pipe they are closed and the elbow is completed. Soldering is not required on the bead seams. Blow-pipe elbows are also produced by this machine.

The Effect of Fatigue on Output

Recent Studies of Fatigue in Industry Indicate that Many of the Conclusions of the Past are Not Altogether Accurate

MUCH has been written on the subject of the effect of fatigue on output. Some recent observations made by G. J. Stegemerten, superintendent of the time-study department of the Westinghouse Electric & Mfg. Co. at East Pittsburgh, Pa., would indicate that many of the conclusions drawn in the past have not been altogether accurate and that sometimes the investigator has more or less made up his mind in advance as to the conclusions that he was to reach, and has found that his observations merely proved his preconceived ideas. Mr. Stegemerten feels that without minimizing the importance of the work that has been done in the past, he is justified in saying that only half of the story has been told.

It is generally believed that output should build up during the first half hour or so of the working day as the worker gets into his stride. When he has once reached his peak, he is able to continue to produce at his maximum rate until he experiences fatigue, and then his output begins to decrease, until at the end of the working period it has fallen off appreciably. In an eight-hour working day, divided into two four-hour periods with an interval for lunch, the curve of the afternoon production is similar in shape to the curve of the morning production, except that it is supposed to be somewhat lower because of the fatigue accumulating during the day.

This reasoning seems quite logical, but recent observations indicate that it does not always hold true. At the Westinghouse plant very careful observations have been made on a number of operations to determine whether this theory is correct. One job observed was that of charging a battery of open-flame tilting furnaces in the brass foundry. The operation consisted of throwing ingots weighing 90 pounds each, as well as pieces of scrap weighing up to 50 pounds or more, into the furnace. It might be expected that after a day of this kind of work, the charging of the last few furnaces in the afternoon would take longer, and that greater fatigue would be noticed in the summer. However, a long series of studies justified no conclusions to this effect.

Similar conditions were observed in the iron foundry, where the molders carried on pouring at an even pace throughout the entire pouring period. This condition was not the result of supervisory driving, but wholly a matter of individual action. In this case, the work was piece-work. Each man knew that the more he produced the more he earned; hence he maintained an even pace. Apparently this pace was not in excess of the men's strength, for many of the molders have been on the job for several years and are in the best of physical condition. All-day fatigue studies showed no slowing up in the afternoon.

Observations of men engaged in lighter work, like drill-press operators performing a routine job, always have shown a *higher* production in the afternoon than in the morning. In fact, the operators do not seem to get into the proper pace until after lunch.

Monotony of work has often been supposed to increase fatigue; yet there are workers who object to a change in work and who prefer to remain at the work they have been doing for years. Such workers would be likely to show more fatigue when their jobs were changed frequently than when they continued to do the same work day after day.

From these observations it is apparent that there is no general rule that can be applied to fatigue. There are too many exceptions to permit of a general rule. None the less, there is, of course, such a thing as fatigue, but the effect varies greatly in different individuals. What tires one man is the very kind of work that another man likes. The mental attitude has much to do with fatigue.

Studies intended to show that production has been increased by enforced rest periods are inconclusive. It is true that there are cases where this has been done; it is equally true that production has been increased by the abolition of rest periods.

For this reason, noting the variation in individuals, it is well to be suspicious of the results of fatigue studies which seem to follow a set rule too perfectly. Often fatigue studies are made with the full cooperation of the worker. The purpose of the study is explained to him and the expected results may be suggested by the explanation. Under those circumstances, it is quite likely that the expected results will be attained. The worker may not consciously vary his pace to suit the expectations of the observer, but the power of suggestion is strong, and if the worker is asked from time to time if he is beginning to feel tired, he probably will answer "yes" in all good faith.

The most dependable fatigue studies will be obtained when the worker is not told what the observer is looking for, provided only that the observer is of the type that can inspire enough faith to make the worker realize that the results of the study will not affect him harmfully.

The Increasing Use of Resistance Welding

AT the Production Meeting of the Society of Automotive Engineers held in Cleveland, Ohio, September 18 and 19, in conjunction with the National Machine Tool Exposition, J. A. Weiger, of P. R. Mallory & Co., Inc., read a paper entitled "Resistance Welding in the Automotive Industry," which reviewed the present status of resistance welding in automotive production. The following paragraphs are abstracted from Mr. Weiger's paper.

Resistance welding makes possible the uniting of forgings and stampings into integral, strong, light-weight parts at a speed unequalled by any other process. A motor car in which practically no castings are used, except in the power plant, can thus be produced. In this way, economies in material and weight are effected.

The trend in modern welding practice is toward the use of automatic machines. These are found advantageous even in cases where production is not continuous. One of the most important advantages of automatic operation is the elimination of operator fatigue, thereby maintaining production at a high level; in addition, better, smoother, and more uniform welds, lower current consumption, and longer electrode life are factors of importance.

A test was made in an automobile body plant, using an automatic welder versus a foot-operated machine. The automatic machine produced four times as many welds before point dressing was necessary as the foot-operated machine, gave one-third greater production, and produced better welds. In addition, savings were made in inspection, materials, and replacements of the welded product.

The types of resistance welding most generally used in the automotive industry are spot-welding, flash butt-welding, upsetting, seam welding, and projection welding. One of the popular cars today has 3240 resistance welds in the body and chassis, of which 44 are flash butt-welds, 2 are seam welds, and 3194 are spot-welds. In addition, there are a number of welds in the parts made by part manufacturers and by makers of accessories used on this car. Only a few years ago, there were but 1339 resistance welds on this car.

Types of Spot-Welding Machines Used in the Automotive Industry

Spot-welding in the automotive industry is performed on machines ranging from approximately 10 KVA to many hundred KVA, and having capacities for making from one weld to several hundred during each cycle of the welder. Spot-welding machines can be classified as follows:

1. Machines for making one spot-weld at a time —the conventional type of spot-welders.
2. Machines consisting of fixtures in which the parts are assembled and welded one spot at a time, using bar and gun welders.
3. Machines in which the parts are assembled and in which all welds are made at the same time by parallel electrodes.
4. So-called "hydromatic" welders in which as many as several hundred spot-welds are made during one cycle of the welding machine, but not necessarily all at the same time, as is the case with the parallel multiple spot-welder.

As body stampings increased in size, it became more difficult to handle the sheet metal on stationary welders. For this purpose, welding fixtures were developed which clamp the stampings to be welded in the right position. The welding is then performed by means of bar and portable or gun welders. With the bar type welder, the pressure on the point is usually produced by the operator. In the case of the portable or gun welder, the pressure is applied mechanically.

Other methods of assembling large stampings are the parallel spot method and the hydromatic method. With these methods, the parts to be welded are inserted in the machines and clamped in position. In the parallel spot method, the machine contains one or more transformers. A number of electrodes are connected in parallel to each transformer and the pressure is made uniform throughout by spring adjustments. When more than one transformer is used, best results are obtained by operating only a few of the transformers at one time. For example, on a machine that welds a door and that produces thirty-two welds, there are four transformers, and in this instance, two diagonally opposite transformers first make sixteen welds, after which the other two transformers make the remainder of the welds.

Flash-Welding and Upsetting

Flash-welding is utilized for welding the rear and side panels of the body, wheel rims, and a number of parts of the chassis. Its special application is for work requiring a smooth and invisible joint. The flash-welding method of combining forgings, steel tubing, and sheet metal is very satisfactory. Many parts of the chassis are flash-welded. A number of these parts consist of forgings welded to tubes, in which case the parts are fully machined

before being welded. After the flash-welding operation, the flash is removed by a trimming die and the parts are then ready for assembly into the car without further machining. This makes possible the machining of small pieces in small equipment instead of the handling of very large castings with bulky and slow operating machines.

Electrical upsetting, which is not so common as some of the other types, is practiced to great advantage in the assembly of roller bearings.

Seam and Projection Welding

Practically all gasoline tanks are produced by electric resistance seam welding. The tanks are usually made from terne plate. The baffles are spot-welded in position, after which the tank proper is seam-welded. This operation is performed by passing the lapped joints between two rolls which operate at a lineal speed of from 6 to 10 feet a minute and are so regulated that there is a series of spot-welds, one overlapping the other, resulting in a perfect seal.

Projection welding is utilized for joining small parts in cases where more than one weld is necessary. Usually small projections varying in size with the thickness of the material are raised on one piece only, and the two pieces are then clamped between dies and all welds made at the same time.

The limitations of the projection welding method are transformer and machine capacity and design of parts to be welded. In projection type welding, the upper and lower dies are solid, and it is necessary that, after the parts are clamped between the dies, uniform pressure be distributed over all the projections.

Materials for Welding Electrodes

One of the most essential parts of the resistance welding machine is the die or electrode material. Originally copper was used, but it was soon found to have too short a life on many of the automatic machines to produce the necessary results. For spot-welding there are available today a number of alloys that have a life three to twenty times that of copper. Experience indicates that for spot-welding cold-rolled steel, a very high electrical conductivity is desirable, and it has been found that the alloy used for spot-welding tips should have a conductivity at least 75 per cent that of pure copper, and a hardness from 65 to 85 Rockwell B.

The correct pressure for spot-welding cold-rolled steel is approximately 15,000 pounds per square inch of electrode area. As the tip mushrooms, the pressure decreases and the current density decreases. After a certain time, poor welds will result. Many shops do not allow the machine operator to dress his own tips, but have tool men to replace the tips, which are then remachined. This gives an opportunity to have the tip made exactly to the desired size and shape; at the same time, the pressure can be adjusted to suit.

The tip material is even more important on multiple spot-welding machines, where as many as several hundred tips are used in the same machine. It can be readily seen that if the tips are not uniform, much trouble will be encountered, due to variations in current density, resulting in a large percentage of bad welds.

The Water-Cooling of Spot-Welding Tips

Water-cooling is necessary on all types of spot-welding tips; unless the tips are properly cooled, the life will be greatly reduced. Recently, a thorough study was made of the proper water-cooling of spot-welding tips. A tip was made from stock 5/8 inch in diameter by 1 1/2 inches long, with a 1-inch deep hole, leaving 1/2 inch of metal from the bottom of the hole to the face of the tip. It was noted that the first 1/4 inch of this tip wore away quite rapidly, and as the metal approached the water hole, more welds were obtained between redressings. Various depths of holes were experimented with, and it was found that a tip made with 1/4 inch of solid metal from the bottom of the hole to the face of the tip was most economical. This tip produced the same number of welds as the tip that had 1/2 inch of solid metal between the bottom of the hole and the face of the tip. The result was economy in material, fewer redressings, and more uniform and better welds.

For seam-welding wheels the same special alloys can be utilized as for spot-welding tips. In order to obtain the longest life from the various alloys, it is essential that the wheels be properly water-cooled. The ideal way to water-cool the wheels would be to spray water directly on them and on the work being welded. This method is practiced to great advantage by some manufacturers.

Die Materials for Projection and Flash Welding

In projection welding, it is necessary to maintain parallel relations between the opposite faces of the dies. If the dies wear non-uniformly, or if the projections produce cavities, non-uniform pressures and current densities will result, thereby producing non-uniform welds and a large number of unwelded sections. A copper-tungsten alloy known as Elkonite has been found very satisfactory as a facing material for projection welding dies. Copper tungsten is used as a facing for plugs which are fitted in the water-cooled backing, or if the projections are close, an entire facing approximately 1/4 inch thick, is recommended. The alloy can be readily silver-brazed to the high-conductivity metal backing.

The die material for flash-welding must be sufficiently hard to stand up under the high pressure and at the same time must have the necessary properties so that the flash produced during the welding will not stick unduly to the die material.

For making long flash welds, such as the rear welds on bodies, special bronzes produce satisfac-

tory results. For making short flash welds, such as on wheel rims, satisfactory results can be obtained by facing the water-cooled die with Elkonite.

For electrical upsetting, it is necessary to have a die or electrode material that is not too high in heat conductivity; otherwise the end of the material being upset will be chilled too rapidly and not upset uniformly. In addition, the material must be extremely hard in order to withstand mechanical wear, and at the same time, be able to withstand the electrical erosion caused by the slight arcing and concentrated heat produced by the uneven surface of the material to be upset at the beginning of the heating operation. A die or electrode material that fulfils these specifications is made from tungsten, molybdenum, and copper.

Possibly one of the most outstanding examples in resistance welding has been the Ford wire wheel. This wheel is made by first flash-welding the rim, after which the rim is formed to the proper cross-section. The hub is made of two stampings spot-welded together. Thirty-two spokes are then welded to the hub and rim, one end of the spoke being welded at one time.

Welding Machine Performs Six Operations in Fabricating Transformer Cooling Tubes

AN automatic machine that performs six different operations is used at the Pittsburgh plant of the Allis-Chalmers Mfg. Co. in the fabrication of radiator tubes for transformers. This machine takes strip steel from a roll, as shown in Fig. 1, presses six lengthwise grooves into the steel as it passes between rollers, folds over the grooved stock, crimps the two edges, welds them together, and then cuts off the welded tube into 12-foot or other convenient lengths. Tubes ranging from 5 to 12 feet in length are made on this machine. The operation of the machine is entirely automatic, a 12-foot tube being produced every 1.2 minutes. This high fabricating speed is made possible by the automatic shielded carbon arc process of welding developed by the Lincoln Electric Co., Cleveland, Ohio, who collaborated with the Allis-Chalmers Mfg. Co. in designing the machine.

The steel strip stock is 9 5/8 inches wide and of 16 gage. After passing under the carbon arc, which welds the edges together, the tube emerges from the machine in a continuous piece. A saw, shown in Fig. 2, which travels in the same direction and at the same speed as the tube while taking a cut, cuts off the tube in pieces of the required length.

* * *

Plywoods and veneers bonded with Bakelite resinoids have found many useful applications. These new plywoods stand up well under tests of alternate immersion in water and drying. Hence they withstand exposure to the elements exceptionally well. They are being used for electric utility cabinets, radio covers and cabinets, etc.

Fig. 1. Flat Stock from Reel is Grooved, Folded, Crimped, and Welded into Tubular Form at This End of Machine

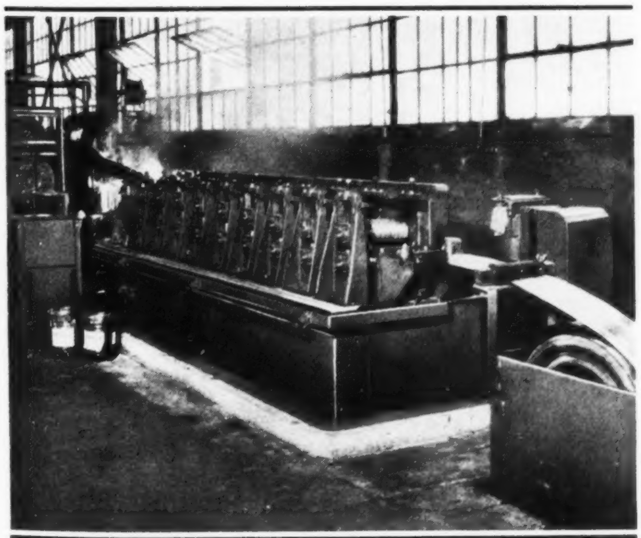
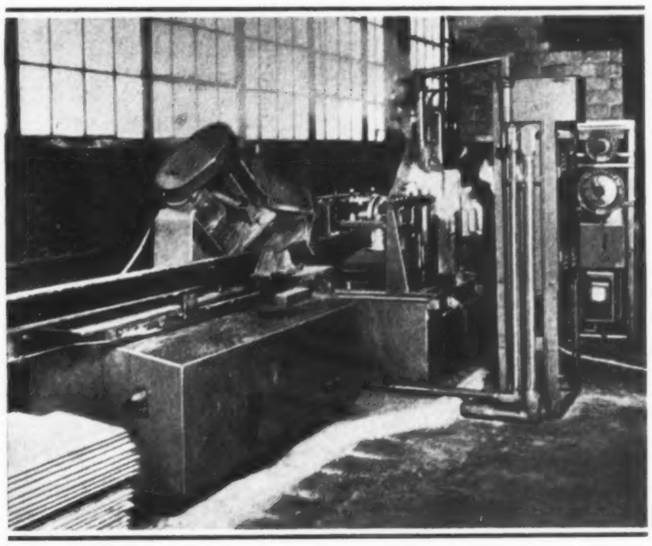


Fig. 2. The Welded Tube Emerging from the Machine Shown in Fig. 1 is Cut off Automatically into 12-foot Lengths



Small Aluminum Die-Castings Made in Machines of Simple Design

By CHARLES O. HERB

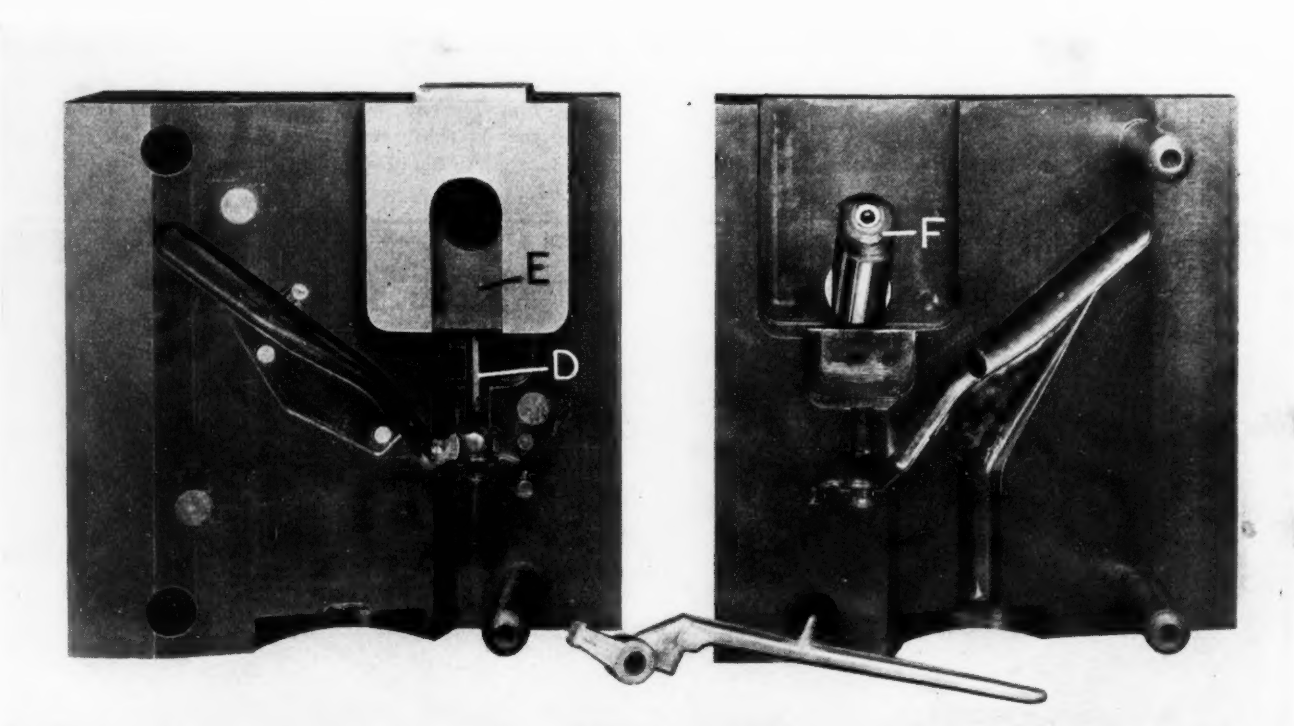
TWO articles dealing with the production of die-castings by means of comparatively inexpensive equipment appeared in the July and August numbers of MACHINERY. They described the casting of parts from zinc and lead alloys. The present article deals with the casting of small parts from an aluminum alloy, using the same type of equipment. An unusually irregular parting line is a feature of the dies to be described, which is necessitated by the design of the parts.

Irregular Parting Line is a Feature of the Dies

In casting parts from an aluminum alloy, the melting pot must be held at a temperature of approximately 1300 degrees F. Such a high temperature requires adequate cooling provisions in order to prevent the dies from becoming excessively hot. In Fig. 1 are shown the dies designed for producing the hair-clipper handle shown in the upper part of Fig. 2. Holes *Y*, Fig. 3, permit the circulation of sufficient cooling water across the die members in the vicinity of the sprue hole to enable these aluminum parts to be cast successfully.

The parting line of these dies is of particular interest because of its irregularity, which is necessitated by the angularity of the clipper handle. Core *D* is automatically withdrawn from the casting when the movable die is drawn away from the stationary die, on account of the engagement of pin *F* on the stationary die with the angular hole in holder *E*. The vertical movement of core *D* and its holder is about 1/2 inch. Holder *E* is held to the face of the movable die by means of a plate.

Fig. 1. Dies Made with a Parting Line of Unusual Irregularity, which was Necessitated by the Shape of the Part Produced



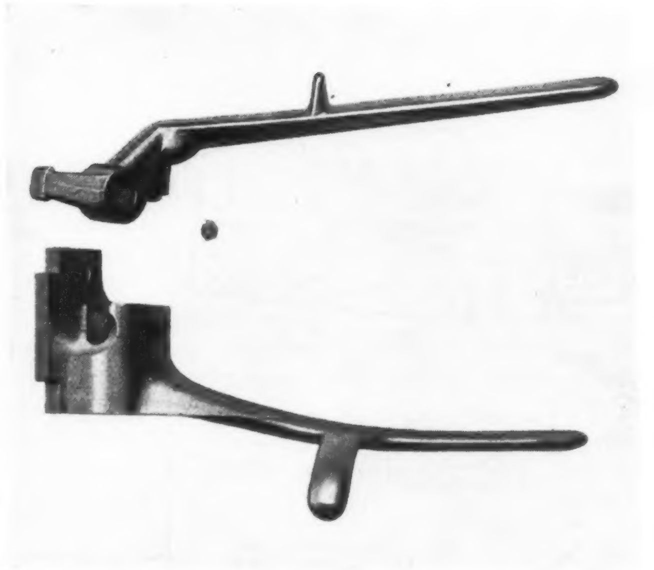


Fig. 2. Aluminum Hair-clipper Parts Cast in the Dies Shown in Figs. 1 and 5

Spring detent H retains part E in the raised position when the dies are opened.

Ejecting pins attached to plate J force the casting from the movable die during its withdrawing stroke as the plate J strikes rod K. However, the ejecting pins do not come in direct contact with the casting. Instead, they are positioned to contact with the flash that is allowed to form at several points along the handle. The position of these ejecting pins can be observed in the upper left-hand view, in which the ejecting pins are marked by cross-lines. Plate J is returned to the illustrated position by two pins L coming in contact with the face of the stationary die when the movable die is brought into the closed position.

A small steel axle, 1/4 inch in diameter by 7/8 inch long, is cast in one end of the lower clipper handle seen in Fig. 2. This axle is indicated by letter X in two views of Fig. 4, which show details of the dies that produce this handle. A photograph of the dies is reproduced in Fig. 5, the stationary die being shown at the left and the movable die at the right.

As this clipper handle is also an aluminum casting, the dies become too hot to permit the steel axle

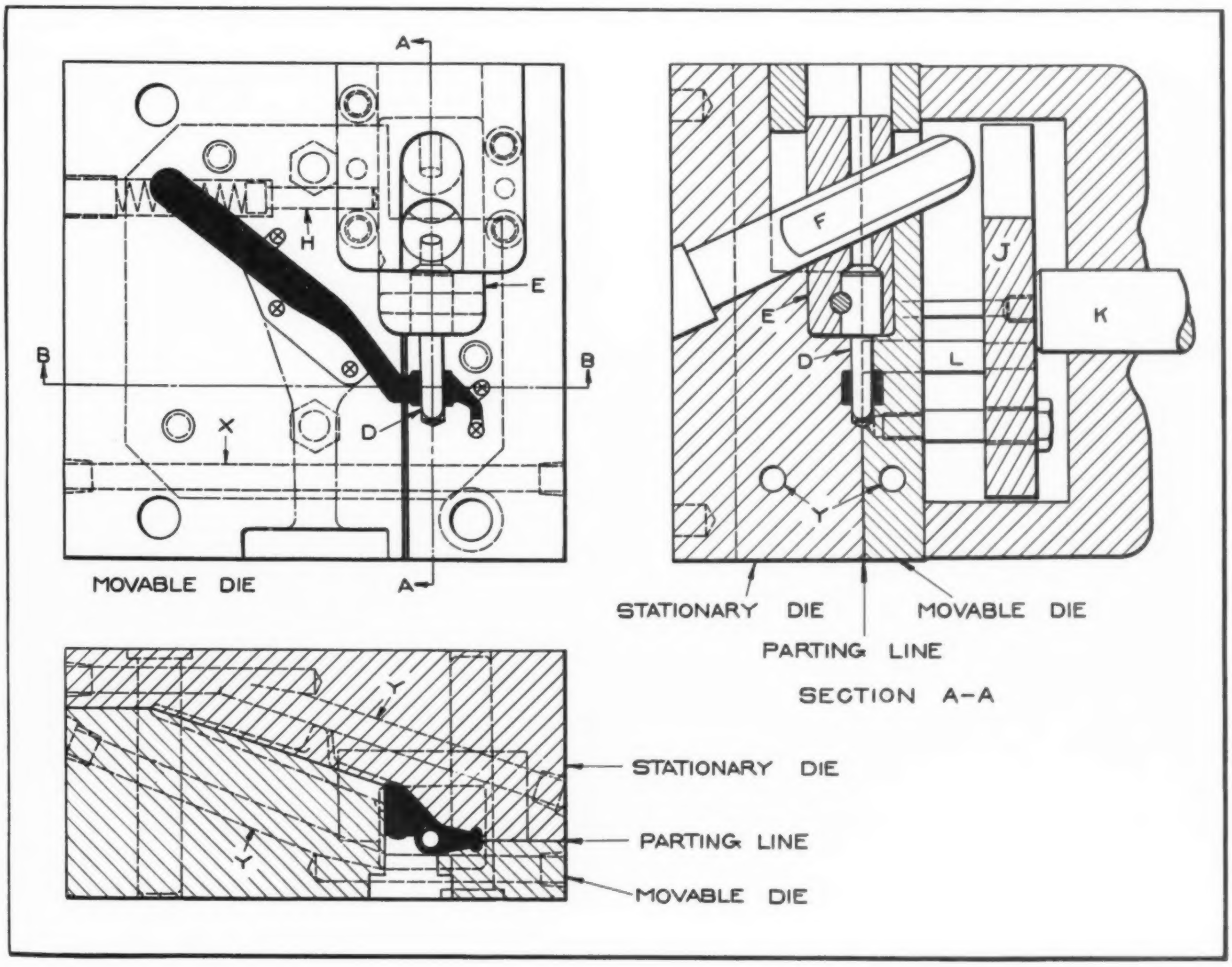


Fig. 3. Construction Drawing of the Dies Shown in Fig. 1. Note Irregularity of the Parting Line in the Lower View at the Left

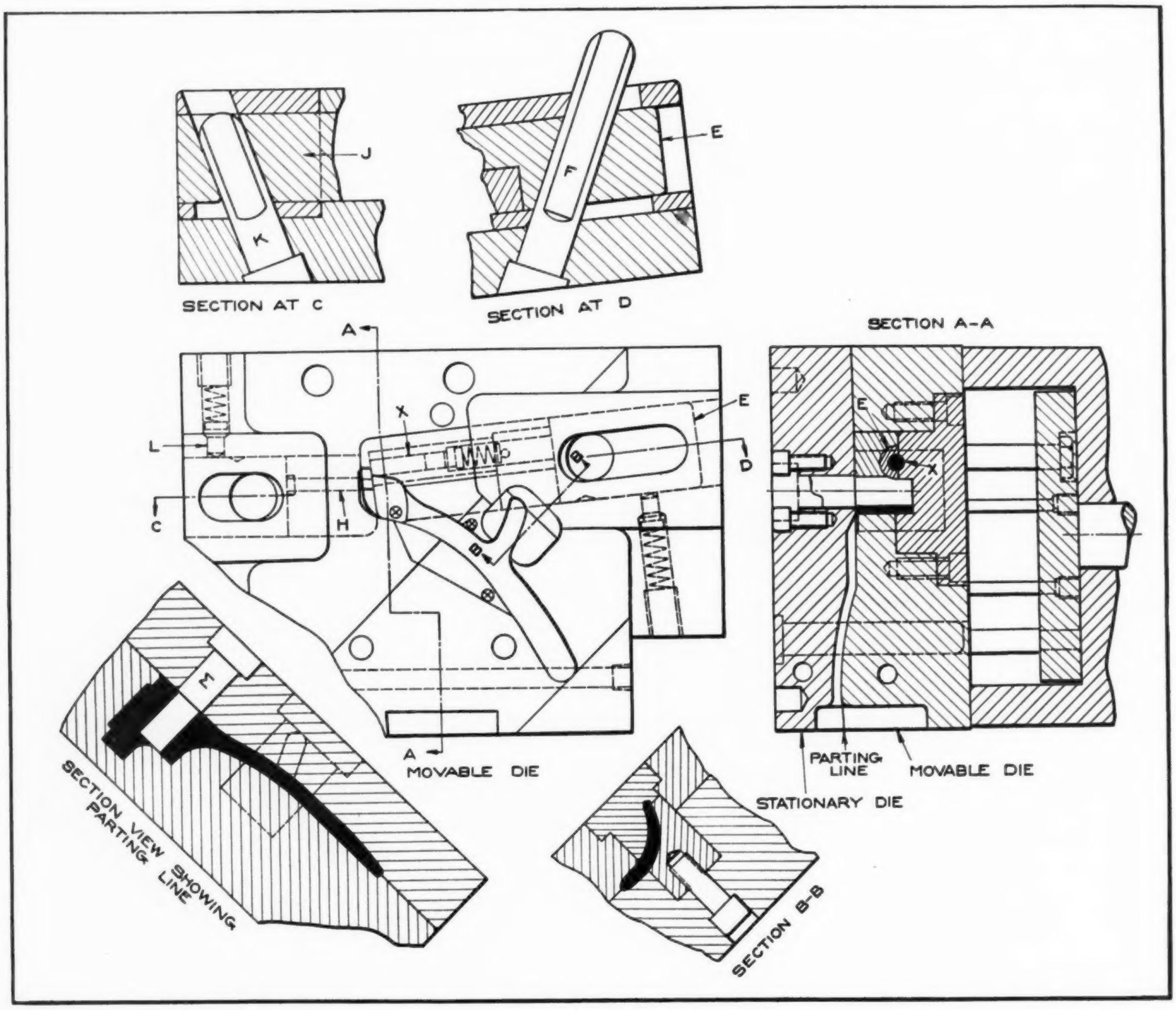
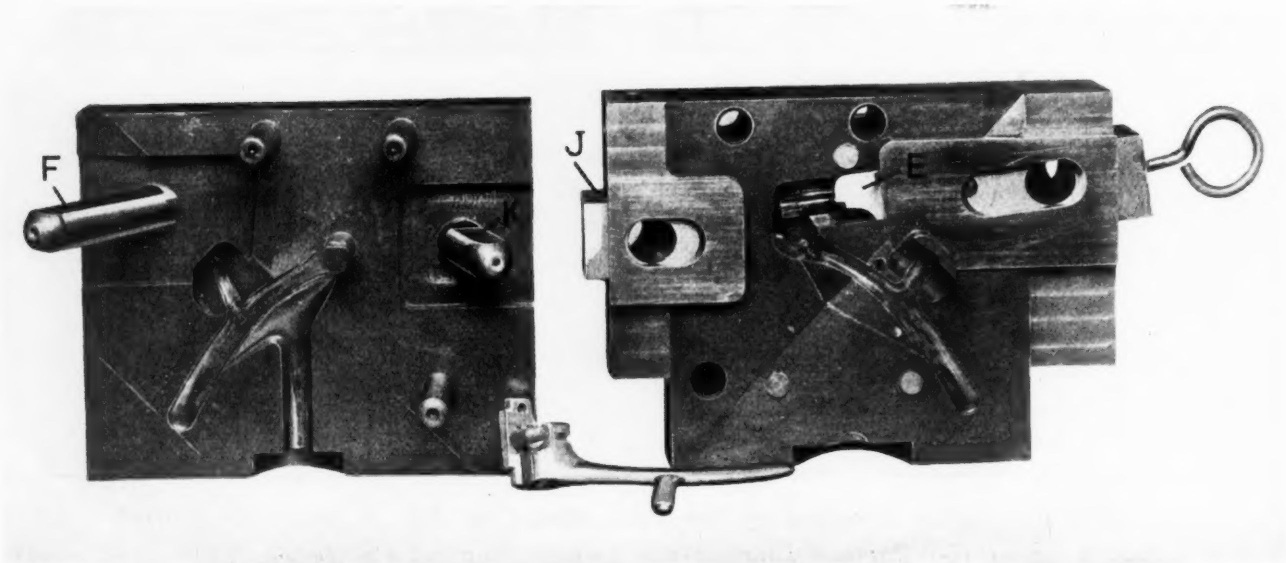


Fig. 4. Die-casting Die Made with a Removable Block to Facilitate the Casting of Small Steel Inserts in Aluminum Pieces

Fig. 5. Dies for Producing Hair-clipper Handle Shown at Bottom of Fig. 2. The Details of the Dies are Shown in Fig. 4



to be placed in the dies by hand. Hence, the movable die was made with a removable block *E*, which is taken out of the die after each operation and loaded with a new insert.

Block *E* is automatically moved sidewise a distance of about 5/8 inch as it slides along pin *F* on the stationary die when the movable die is withdrawn. Then block *E* is removed completely from the die by the operator pulling on a handle attached to its outer end, as seen in Fig. 5. The insert is placed in a small hole in the left-hand end of block *E*, as shown in Fig. 4. A spring plunger backs up the insert, holding it against a surface of the cavity in the stationary die. Block *E* is located for casting by pin *F* when the dies are closed.

Core *H* must also be withdrawn from the die cavity at the end of an operation to permit ejection of the casting. This is accomplished by mounting the core in a slide *J*, which is moved sidewise when the movable die is opened, slide *J* being actuated by pin *K* on the stationary die. Spring detent *L* prevents slide *J* from being withdrawn completely from the die after it leaves pin *K*. It will be obvious that core *M* is fixed in the stationary die.

The method of ejecting the casting automatically from the movable die when it is withdrawn from the stationary member is the same as with the dies previously described.

By studying Figs. 4 and 5, it will be observed that this set of dies is made up of an unusual number of pieces. This sectional method of constructing the dies greatly reduced the problems of the tool-room. Also, as the die pieces become worn, they can be replaced at minimum cost.

Bakelite Corporation Commemorates Twenty-Fifth Anniversary of a New Industry

THIRTY years ago, in a small laboratory at Yonkers, N. Y., Dr. L. H. Baekeland, a chemist, started some researches, which, in 1907, resulted in the discovery of Bakelite resinoid, a material that was destined to play an important part in the industrial progress of the world, and a discovery that led to the foundation of a new industry.

On the basis of this discovery, the General Bakelite Co. was formed in October, 1910. The Bakelite Corporation, as the company is now called, thus has completed twenty-five years of continuous development. From a small beginning it has had a normal, healthy growth, adding new varieties of Bakelite resinoids and discovering new applications. In 1922, the Condensite Co. of America and the Redmanol Chemical Products Co. were consolidated with the General Bakelite Co. to form the present Bakelite Corporation. As a result of the opening up of new markets and the constantly increasing number of new materials, the company established plants at Perth Amboy, N. J., Chicago, Ill., and Toronto, Ontario. Foreign affiliations followed in quick succession in Germany, England, Japan, and Italy. In the early part of 1930, all the American factory facilities were consolidated into an entirely new plant at Bound Brook, N. J., in which two thousand varieties of Bakelite materials are produced.

In commemoration of its twenty-fifth anniversary, the Bakelite Corporation has issued a 40-page edition of its magazine, *Bakelite Review*, in which is traced the history not only of the Bakelite Corporation, but of the plastic industry in general, during the last twenty-five years.

Welding Facilitates Fabrication of Small Racing Cars

THE extent to which oxy-acetylene welding can be successfully employed in fabricating intricate parts that are subject to severe usage is indicated by the construction of a midget racing car by a western manufacturer. According to *Oxy-Acetylene Tips*, this car, which is one of five that have won main events on the largest track on the West Coast, is capable of reaching a top speed of 125 miles per hour on a straight course with a 70-horsepower motor of welded construction.

The motor block is entirely fabricated by oxy-acetylene welding. The head has over sixty-five pieces of steel and tubing, all of which are welded. The cylinder block and water jacket are fabricated by the use of an oxy-acetylene flame on those parts that become hot when the motor is in operation, and by means of the air-acetylene flame (using hard solder) on those parts that are water-cooled. The assembly is completed with a four-cylinder motorcycle crankcase and shaft. The cylinders consist simply of high-strength steel tubing. Sheet metal is used for the block and jacket.

The chassis is of light-weight steel sections, all oxwelded. Bolts are used only for such parts as brake hangers and other units that have to be removed from time to time for adjustment. Other parts fabricated by oxwelding include the steering gear case and drive shaft; the body, of sheet aluminum; the gasoline tank, of sheet steel; and the manifold and exhaust pipes.

Engineering News Flashes

The World Over

Diesel Engines for Automobiles

The firm of L. Gardner & Sons, Manchester, England, has produced a Diesel oil engine for automobiles that is said to be very economical. It has been fitted to a Lagonda sports car with good results. The firm is said to be starting commercial production of the new engine. Further experiments are necessary before the engine can be applied to the small British car, but it is said to be suitable in its present form for cars weighing about 3000 pounds. No magneto or coil is necessary. The oil is fired entirely by compression. For that reason a rather heavy engine is required now, but it is hoped by further research and tests to be able to lower the weight.

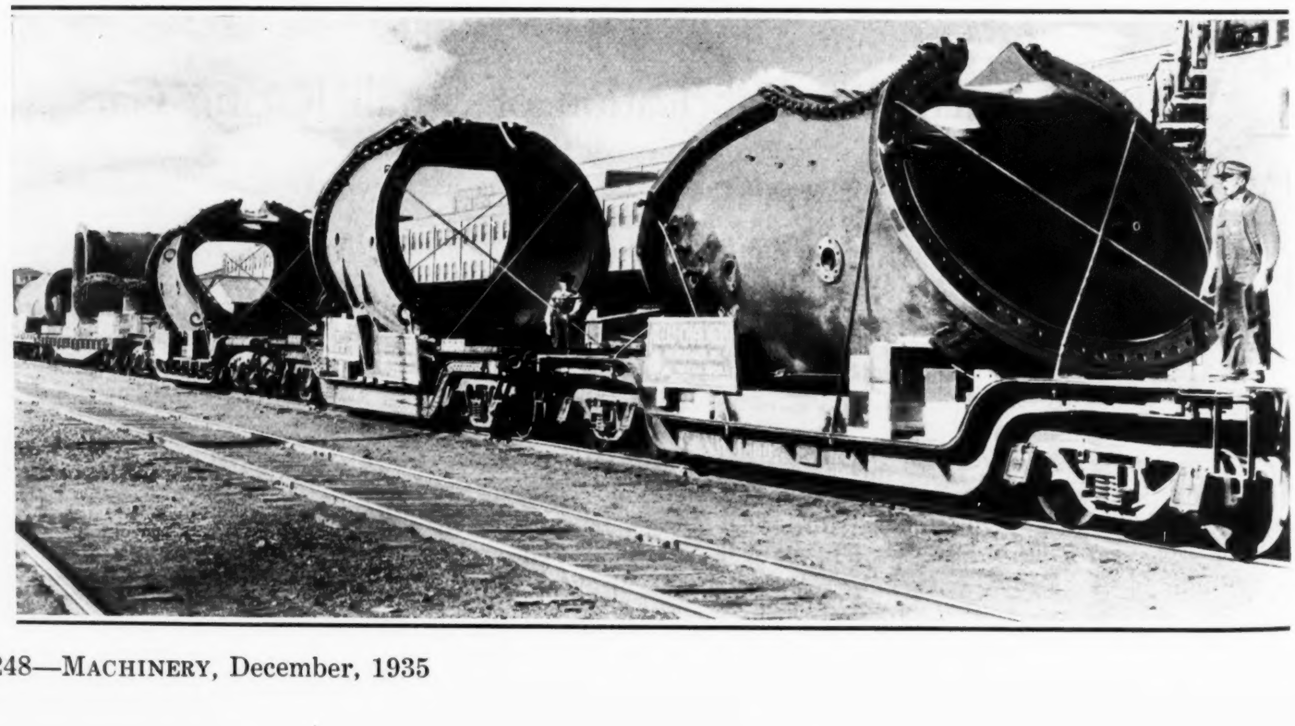
New German Synthetic Plastics

According to information received from abroad, a new line of synthetic plastics has recently been placed on the market in Germany under the trade name "Acronal." These plastics are polymerised vinyl compounds. They are claimed to have a clear, colorless appearance, to be unaffected by low temperatures, and to have an elasticity similar to that of hard rubber. They are unaffected by petroleum products.

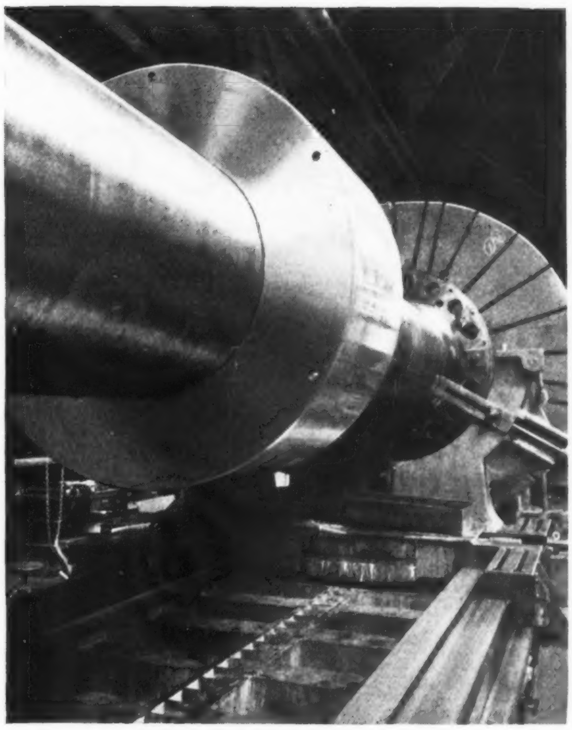
Electric Furnaces of Huge Proportions

Thirteen bell type electric furnaces, larger than any of this type heretofore constructed, are being installed by the General Electric Co. in the Rouge plant of the Ford Motor Co., where, in conjunction with twelve other bell type furnaces built by another manufacturer, they will be used to anneal strip steel. Each furnace is of sufficient capacity to bright-anneal in one charge two 16,000-pound coils of steel strip 48 inches wide and 52 inches outside diameter. The advantage of the electric furnaces is that the steel comes from the furnace bright and clean. The annealing cycle is in the neighborhood of forty-five hours—much shorter

A Shipment of Parts for Four 115,000-horsepower Hydraulic Turbines Built for the Boulder Dam Power Development by the Allis-Chalmers Mfg. Co., Milwaukee, Wis.



Turning the Main Shaft for One of the 82,500-K. V. A. Generators for the Boulder Dam Hydroelectric Development, at the Plant



of the General Electric Co. in Schenectady. This Shaft is Over 36 Feet Long, 5 1/2 Feet Maximum Diameter; Weight, 108,000 Pounds

than for the conventional fuel-fired equipment. The electrically annealed steel is also said to have better ductility—that means better deep-drawing properties—and to be more uniform than that annealed by the conventional method.

Unusual Application of Stainless Steel

Sheffield stainless steel is being employed to line part of a river bed in Yorkshire, England, in connection with the construction of a new reservoir. The object of lining the river bed with stainless steel is to prevent the channel from becoming choked by moss and other vegetable growth. Thin stainless steel sheets are placed over the concrete which forms the bed of the channel.

Hard-Facing Paper Roll Bars

For a number of years the American paper industry has effected considerable economies through the application of hard-facing materials to wearing parts. One application that has proved unusually successful in an eastern paper mill is the building up of worn paper roll bars. These bars are 15 feet long by 3 inches square. Two cast-steel collars are placed on each end and each collar has two hardened steel set-screws to hold it in place. It is important that the collars remain in position during the use of the paper roll bar. In service, however, the set-screws will move slightly, with the result that the metal is worn off or stripped at the point of contact.

In an effort to increase the life of the bars, it has proved to be advantageous to build up the worn part with hard-facing alloys. The alloy best suited for this purpose has been found to be Hascrome, a chromium-manganese-iron alloy having great strength and toughness. The repair work for each bar takes fifty-five minutes. The repaired bar, after eight months' service, is in such excellent condition that it is estimated that it will last without repairs for about ten years, as compared with a former life of about eighteen months.

An Unusual Air Shipment

Previous air-express records are probably excelled by the shipment of approximately 3000 pounds of stator coils and other parts from the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., to California, for the repair of a 900-horsepower, wound-rotor hoist motor, on which the operations at the Diamond Match Co.'s plant were wholly dependent. The shipment was carried by tri-motor planes to Cleveland and then transferred to planes of the United Airlines for California. The shipment was delivered to the customer in California about seventy-two hours after the request for "service with a rush" was received in Pittsburgh.

Gasoline from Coal

Arrangements are being made for doubling the output of gasoline from coal at the British Seaham Harbour plant. This plant, it is expected, will produce 4,000,000 gallons of gasoline a year, the same quantity of heavy oil, 100,000 tons of smokeless fuel, and many other by-products.

EDITORIAL COMMENT

Cost Reduction Efforts Must Not be One-Sided

To reduce the cost of doing business is just as important as to secure more business. Reduced manufacturing and selling costs are a sounder foundation on which to build a business than mere increase in sales. Bigness in a manufacturing organization has no merit except as it represents efficiency in production and distribution. This efficiency must be capable of being translated into reduced costs, better product, and improved service.

In all cost-reduction efforts, one-sidedness should be guarded against. There have been many examples of reduced manufacturing costs accompanied by increased distribution or selling costs. If reduction in costs in one direction is merely absorbed by an increase in costs in another direction, little is gained. The rate of efficiency must apply in approximately the same degree in all directions.

It Takes a Good Man to Know When to Slight Work

That there is a great deal of time and effort wasted through careless and inaccurate work is too well known to every man responsible for the output of a machine shop. It is not so well recognized, however, that a great deal of time and effort are sometimes wasted in making work too accurate —that is, in working to closer tolerances than the purpose of the work requires. The troubles due to inaccuracy and carelessness are obvious, but the useless expense due to too great accuracy is not so easily recognized. Yet, could this cost be measured in dollars and cents for the entire American machinery industry, it would run into high figures.

Many instances have been called to our attention where an accuracy has been demanded in tools, limit gages, lead-screws, etc., far in excess of what was needed. Sometimes this has doubled and tripled the cost of the equipment. Toolmakers have been known to finish pieces to an accuracy of a thousandth of an inch when the parts merely "fit in the air." The folly and waste of time incident to such practice are obvious; but it is just as much a waste of time to work to tolerances measured in tenths of thousandths on a gage, for example, where wide limits are allowed in the object to be gaged.

Years ago a toolmaker of long experience told us "it takes a mighty good man to know when to slight work." There is a great deal of mechanical philosophy in this simple statement. It is a matter of sound judgment to determine when great accuracy is required and when it is not, and to give to every piece of work exactly the attention that it requires to perform its function efficiently—and no more. The right degree of accuracy is that which adequately serves the purpose without waste of time on unnecessary refinements.

It is Not Enough that it Works— It Must Sell

One of the best known machine tool designers in this country during the last twenty-five years, a man who ultimately became the chief executive of a large machine tool plant, once said that the great failing of many machine designers was their lack of appreciation of the element of cost. "Anybody," he said, "can design a machine to do almost anything, if he can spend all the money he wants; but it takes a real designer to so design a machine that it can be built and sold at a profit."

Ingenuity and technical knowledge are not enough to make a successful designer. A knowledge of commercial conditions, a capacity to see the business man's point of view, and an appreciation of production problems are equally necessary—sometimes more so. The most successful machine designers have been those who have had the idea of cost uppermost in their minds.

The competent designer knows that every unnecessary screw, pin, plunger, gear, or lever not only increases the first cost but also the upkeep. He considers the manufacturing problems that are encountered in the pattern shop, foundry, and machine shop. It is quite possible that the machine may be simple in its arrangement, perfect in its mechanical action, and well proportioned to resist all working stresses, and yet represent a poor and expensive design. It may be too costly to build. The designer who can thoroughly balance mechanical and commercial factors is likely to produce the most successful machine.

Ingenious Mechanical Movements

Mechanisms Selected by Experienced Machine Designers as Typical Examples Applicable in the Construction of Automatic Machines and Other Devices

Geneva Stop Mechanisms of Modified Design

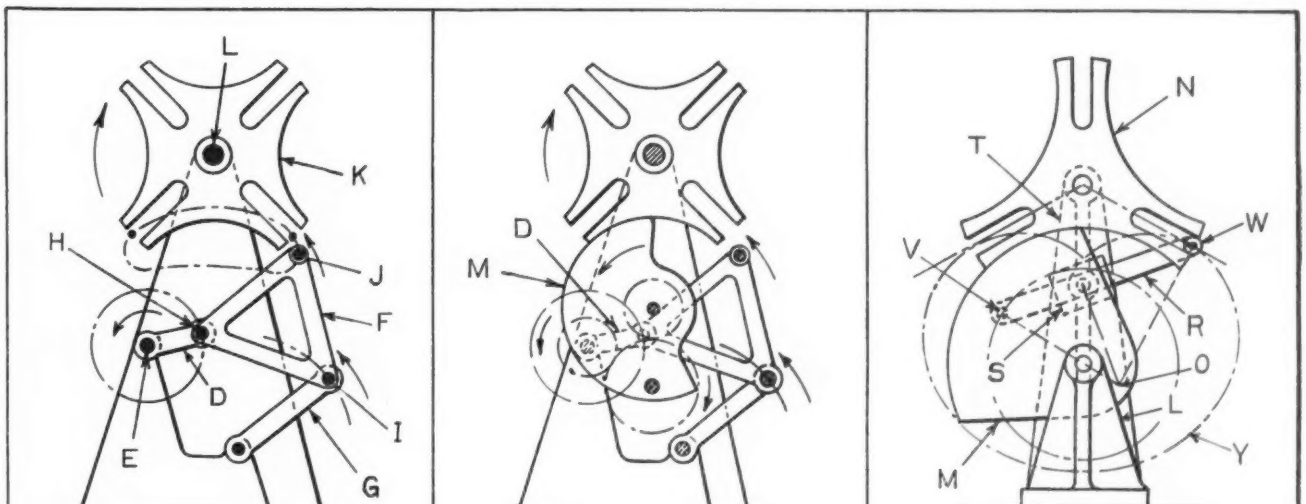
By PAUL GRODZINSKI

The Geneva stop mechanism is used frequently because of its simple design and serviceability. In the form generally used, the driving roll enters the radial slots of the driven disk tangentially. With this arrangement, the disk begins its movement from a stationary position and comes to a stop without any shock, but the acceleration and deceleration in the velocity of the disk occur at an exceedingly rapid rate, producing a relatively high angular velocity in the rotating disk. In order to eliminate these disadvantages, a German inventor developed a modified form of Geneva stop mechanisms in which the driving roll that transmits intermittent motion to the cross or slotted disk is replaced by a mechanism consisting of four articulated members, as shown at *A*.

In this mechanism, the driving member *D* rotates on axis *E*, and by means of rod *F*, gives member *G* a swinging motion. As the center of the connecting stud *H* describes a circle and stud *I* moves through only a part of a circle, all other points on the rod or member *F* describe curves of a distinct form. A stud at *J* supports the driving roll for the Geneva stop mechanism. When crank *D* completes a full rotation, roll *J* enters a slot in disk *K* tangentially and drives the disk to the next stopping position, after which it leaves the slot along a tangential path.

The difference between this mechanism and the older well-known arrangement is that the height of the curve followed by the roll on stud *J* is not so great; thus the angular velocity of the disk *K*, which depends on the distance of point *L* from the top of the curve, is considerably reduced. To prevent any unintentional movement of disk *K*, a blocking disk is necessary. For this purpose, a disk *M*, as shown in view *B*, is supplied. This disk is driven by intermediate gears from crank *D*. The addition of this blocking system, however, considerably complicates the mechanism. Another disadvantage of this drive is the bulky unsymmetrical design.

Another similar drive which functions through a turning block linkage is shown at *C*. The small fixed bracket *L* forms the bearing for the shaft of the driving crank *M*. This crank-arm also serves as the blocking disk for holding the driven disk *N*



Geneva Stop Mechanisms of Modified Design Developed in Germany

stationary during the dwelling periods. The crank-arm M is connected at V to the rod R, which slides in a block S, pivoted on the stand T. On the opposite end of rod R is mounted a roller W. As shown in the illustration, roller W describes a heart-shaped curve Y. The upper or spear-shaped portion of the curve Y is used for imparting the driving movement to the three-armed cross or driven disk N.

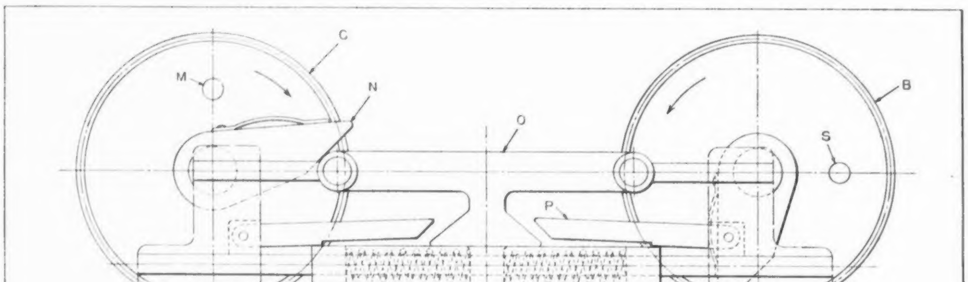
As roller W enters the slots in disk N tangentially, tangents to the path followed by the roller at this point must pass through the center of the disk and the center of the slots, which are radially located. The normal of curve Y is found by extending a line from V through the center of the shaft on which M is mounted, so that it intersects a line perpendicular to rod R, drawn from the center of the fixed stud on which block S is pivoted. A line from the point of intersection O to the center of roller W forms the desired normal to curve Y. This mechanism appears to be suitable for moving picture camera drives and may possibly be applied to machine tools and other machines requiring intermittent drives.

Mechanism for Driving Two Shafts Intermittently and Alternately

By R. H. HOLTON

The mechanism shown diagrammatically in the accompanying illustration was designed for use on a special machine. In operation, the constantly rotating shaft A, through a gear train, drives worm-wheel B one revolution in the direction indicated by the arrow, after which the gear-shifting mechanism functions automatically, causing worm-wheel B to dwell and the driving motion to be transmitted to worm-wheel C through another gear train. After worm-wheel C has been driven one revolution, the gear-shifting mechanism again functions, causing worm-wheel C to dwell while the driving action is again transmitted to worm-wheel B, thus completing the cycle, which is continuous as long as the driving shaft A rotates.

The clutch member D, which is slidably keyed to shaft G, is shown in the neutral position, but when the mechanism is in operation, this clutch is in engagement with either pinion E or F, causing shaft G to rotate in one direction or the other, depending upon which pinion is engaged. The driving of shaft G in either direction from the crown gear on shaft A is made possible by the "free-wheeling" type friction clutches, consisting of two members H and I, and the friction rollers arranged as shown in the section view in the lower right-hand corner of the illustration. Two members I of the proper hand are keyed to the shaft and the two friction members H and J are slipped over them. Thus, when the clutch member D is in mesh with pinion F, the wedging action of the friction rollers serves to lock members H and I together as one piece, while member J runs freely over its mating member I. When the clutch engages pinion E, the direction of rotation of shaft G is reversed, the drive being through friction clutch J, while member H runs free. Thus, the direction of rotation of shaft G is controlled by the movement of clutch member D.



Mechanism for Driving Worm-wheels C and B Intermittently and Alternately from Shaft A, Permitting Dwells of Different Lengths for Driven Members by Using Single, Double, or Triple Thread Worms and Different Sized Worm-wheels

Spur gear teeth on members *H* and *J* mesh with the spur gears *K* and *L*, which have worms cut on their hubs that mesh with the worm-wheels *B* and *C*, respectively. The manner in which the clutch is automatically controlled to give the worm-wheels *B* and *C* their respective intermittent movements is shown by the upper view.

Assume that the mechanism is in operation and that clutch *D* is in engagement with gear *E*, so that worm-wheel *C* is being driven in the direction indicated by the arrow. When pin *M* on the worm-wheel comes in contact with the flat spring on the swinging arm *N*, which is a free turning fit on the worm-wheel shaft, it causes the swinging arm to come in contact with the roller on shifter lever *O*. The latch *P* would be down at this time instead of in the position shown. In the down position, a step on the latch engages a collar *Q* on the shifter slide, preventing the slide from moving to the right. Thus, continued rotation of the arm *N* serves to compress the spring *R* until a cam surface on the shifter lever lifts latch *P*, releasing the spring, which forces clutch member *D* to the right into mesh with gear *F*, engaging the drive to worm-wheel *B*, and allowing worm-wheel *C* to dwell. When this takes place, the shifter lever *O*, being released from the pressure exerted by spring *R*, also moves to the right and the arm *N* is rotated past the roller on lever *O* by the flat spring, previously compressed by pin *M*.

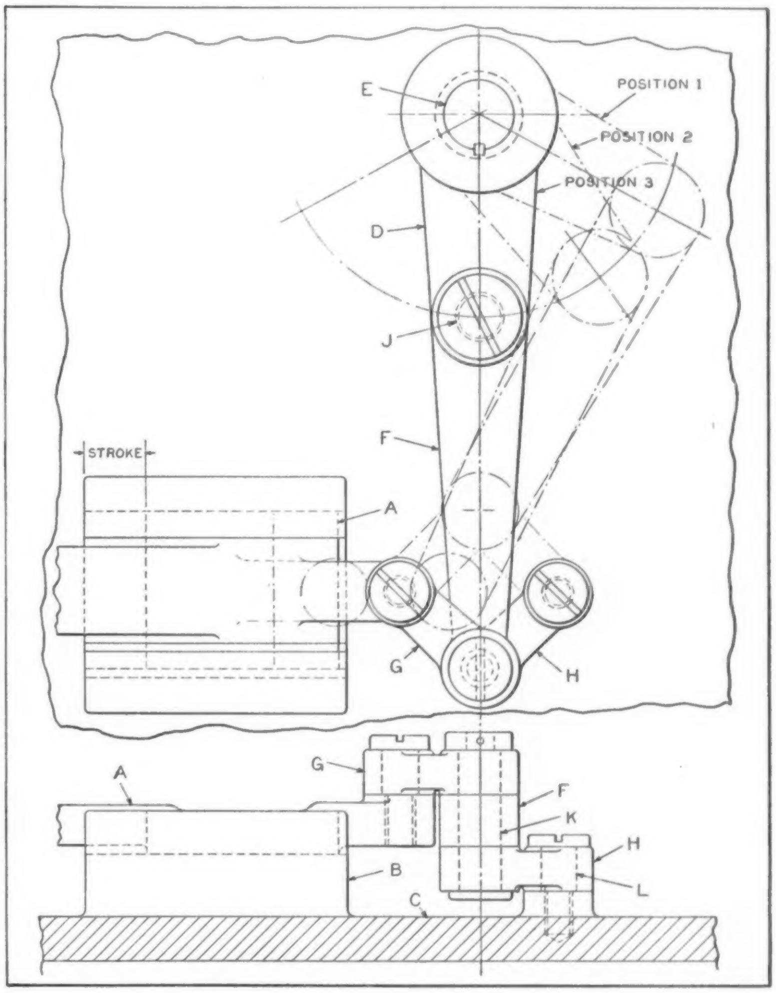
When worm-wheel *B* has rotated through the required angle, the pin *S* comes into contact with the flat spring on a swinging arm similar to the arm *N* previously described. The movement of the clutch member *D* into engagement with gear *E* is accomplished automatically, the same as the movement in the opposite direction. This cycle of operations is repeated automatically.

Oscillating Arm Mechanism for Rapid Reciprocation of Slide

By J. E. FENNO

In a metal ribbon crimping machine, four complete cycles of a slide are obtained from an oscillating arm as the latter passes through one cycle. This arrangement, which is shown in the accompanying illustration, has the advantage of simplicity of design and an unusually smooth action. The slide *A* that controls the crimping tools is mounted in guides *B*, cast integral with the machine frame *C*. Arm *D* is the driving member and is keyed to the shaft *E*, which oscillates at a constant angular velocity. This arm transmits the movement to the slide through a toggle arrangement consisting of links *F*, *G*, and *H*. Link *F* is pivoted at its upper end to arm *D* by pin *J*, and at its lower end to links *G* and *H* by pin *K*. The outer end of link *G* is pivoted to the slide, and the outer end of link *H* is pivoted to the shoulder screw *L* in the machine frame.

Three positions of the arm and links are shown. At Position 1, the toggle links *G*, *F*, and *H* are at their highest points; hence, slide *A* has been drawn to its farthest point at the right. As the arm swings downward to Position 2, these links assume a horizontal position, causing the slide to move to its farthest position at the left. The arm then continues its movement until it arrives at Position 3, where link *F* has forced the toggle links down to their lowest position, causing the slide to be carried back to the position indicated. Thus, during this one-quarter cycle of the arm, slide *A* has passed through a complete cycle. Consequently, as a repetition of these slide movements occurs during each quarter cycle of the arm, the slide will complete four cycles for each cycle of the arm *D*. An added advantage of this toggle arrangement is the unusually high working pressure that is delivered at the end of the stroke toward the left at the point where the pressure is needed most.



Reciprocating Slide of a Metal Ribbon Crimping Machine, Operated by Oscillating Arm and Link Mechanism

Electric Drives Facilitate Machine Tool Operation

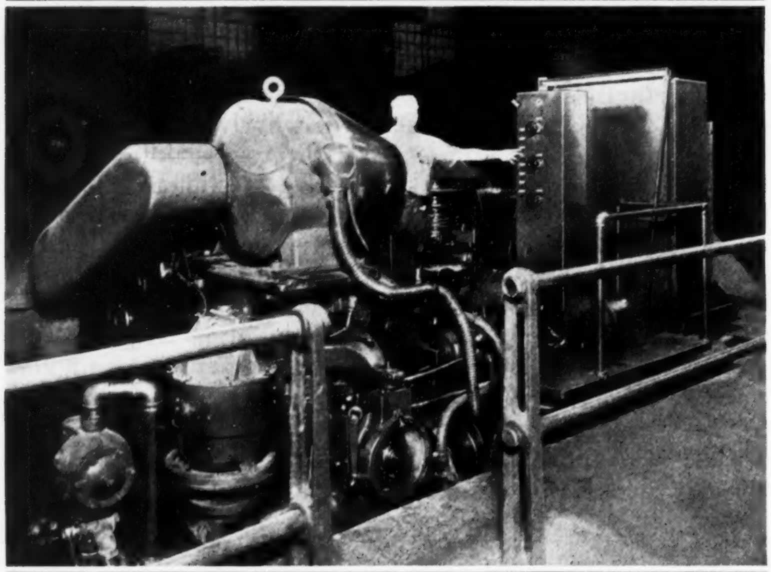


Fig. 1. The Operator of This Landis Roll Grinder Rides on the Carriage, which is Equipped with a Master Control Station for Controlling the Entire Machine

A High Degree of Flexibility in the Operation of Machine Tools is Obtained by the Application of Improved Electric Motors and Electrical Controls

By R. S. ELBERTY
Machinery Electrification
Westinghouse Electric & Mfg. Co.
East Pittsburgh, Pa.

PROGRESS in machine tool development has been accompanied by a broader application of electrical energy and electrical apparatus. Machines using main drive motors have been improved by the addition of auxiliary motors for obtaining feed and traverse motions. Recent developments in electrical control have enabled the interlocking of machine motions to such an extent that automatic machinery can be controlled for the most part by electrical means. In many cases, electrical drives are simpler than those obtained through hydraulic or mechanical linkages.

Large machines can be controlled from centralized panels, which facilitates the set-up operations. Pendant push-button stations give the operator complete control of the machine while moving around the work. In order to get the best results from this scheme of operation, it is advantageous to have all motions of the machine controlled electrically. Electrical control for machine functions does not necessarily require an individual motor drive for each motion. Magnetic clutches can be used to advantage in operating systems of this kind.

The advantages obtained by flexibility in machine operation have resulted in such electrical developments as electric feed with combined rapid traverse for use on planers and similar machines; adjustable-speed, direct-current motors that permit speed changes within a range equivalent to a 10 to 1 ratio with a constant voltage power supply; combined rapid traverse and clamping control; emergency stop pendant push-button stations; and many other arrangements of material assistance to the machine tool builder and user. The introduction of special motors furnishing relatively large power outputs for short-time ratings has served to reduce costs and space requirements of motor-driven rapid-traverse, feed, and clamping mechanisms.

Small machines have been materially simplified through the use of adjustable-speed direct-current motors or multi-speed alternating-current motors. The use of motors that can be operated at different speeds reduces the number of gear changes or increases the number of available speeds. The multi-speed alternating-current motor has been used to advantage on small upright drills for a number of years, and has more recently been applied to grinders, turret lathes, and combination milling and planing machines. Both the multi-speed alternating-current motor and the adjustable-speed direct-current motor have advantages that can be made use of on a wide variety of machine tools.

Quick-Reversing Features

The use of electrically reversible machines has grown rapidly and some of the new tapping machines and turret lathes are capable of making

fifty reversals per minute by means of special reversing motors and controls. The power peak required for reversing tends to limit the size of such applications, but this objectionable feature does not exist when the motor in question forms only a small part of the total electrical load. In a large shop where a 100-horsepower planer motor is frequently reversed, the reversing of, say, a 15-horsepower motor on a lathe should not be objectionable from a power demand point of view.

The gearmotor with its refinements is a relatively new development and has not been broadly applied to machine tools. There have been several very successful applications of this apparatus, however, and indications are that gearmotors may come into more general use for machine tool drives.

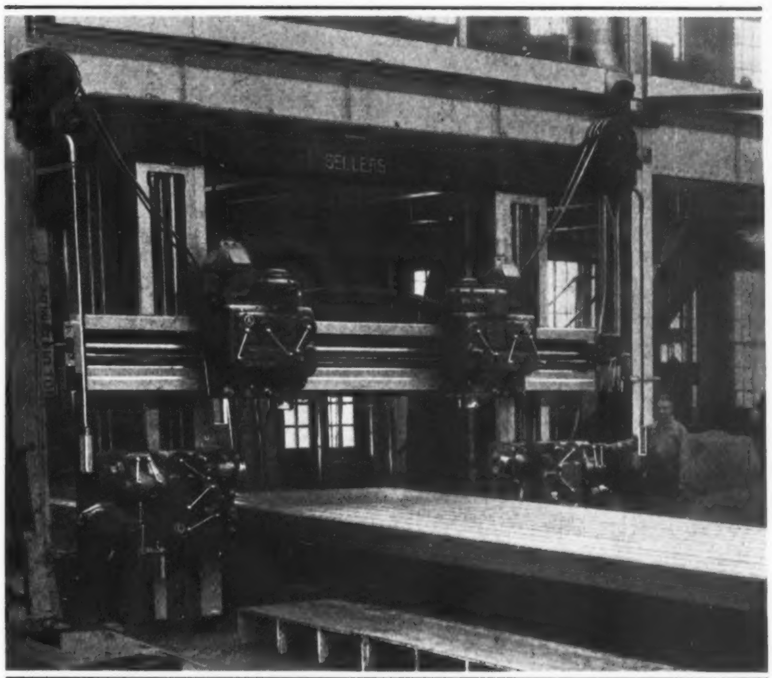


Fig. 2. Sellers Planer Type Milling Machine with Four Milling Heads Equipped with Individual Motor Drive, and Duplicate Pendant Type Push-button Controls

Examples of Electrically Controlled Machines

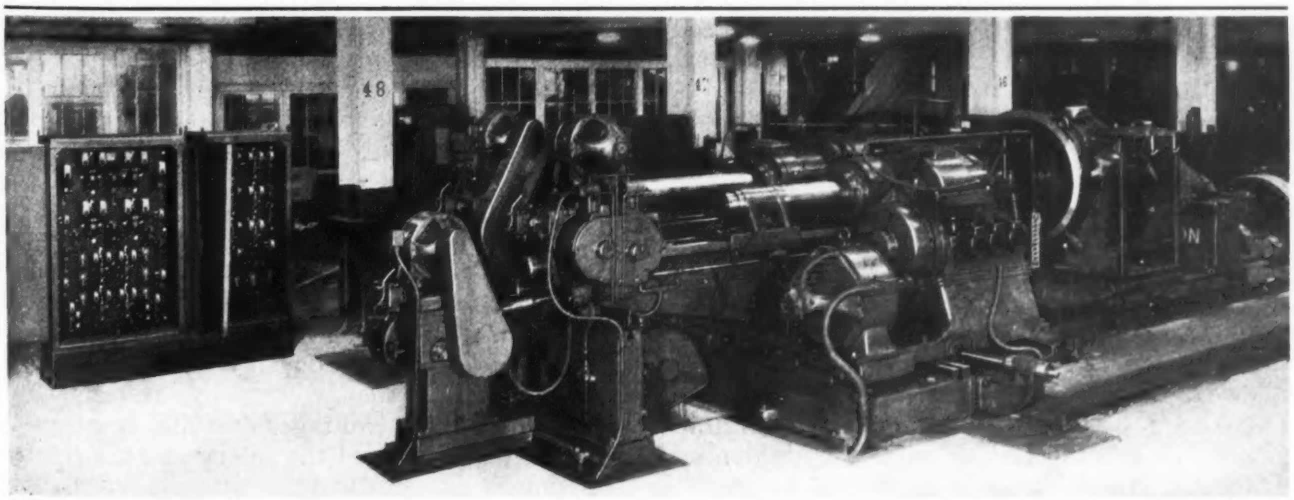
The operator of the roll grinder shown in Fig. 1 rides on the carriage which contains a master control station for the entire machine. Two power wires and one control wire run between the stationary control and the control on the carriage. A special control arrangement provides for starting, stopping, and controlling the speed of the headstock motor over a single control wire. This machine regularly uses six motors, with two additional motors as extra equipment. Adjustable-speed direct-current motors are used for the wheel drive, carriage traverse drive, and headstock drive.

The planer type milling machine shown in Fig. 2 has four milling heads equipped with individual motor drive. Electrical control is centered in the pendant push-button station, which is duplicated on both sides of the machine. A master control station contains the necessary controls for setting up operations and for controlling the direction of spindle rotation, feeds, and speeds.

In Fig. 3 is shown a special three-bar horizontal boring machine employing eight motors. Auxiliary controls are mounted on the machine. The main magnetic controller is separate from the machine.

Because of the large variety of machine tools and the electrical problems involved, the machine

Fig. 3. Consolidated Machine Tool Co.'s Special Three-bar Horizontal Boring Machine with Main Magnetic Controller Separate from Machine



tool builder and the electrical manufacturer find it necessary to work together, in order to determine the most advantageous application of electric power and electric controls. The development of electric control for machine tools has advanced to such a stage that practically all control problems are now capable of solution. The simplest solution of a complex control problem requires specialized knowledge in electrical engineering, such as the electrical manufacturers have made available to the machine tool industry.

* * *

Directions for Ordering Malleable Castings

Frequently the foundryman is not furnished with sufficient information by the customer of castings to enable him to estimate intelligently on a malleable casting order. The Lake City Malleable Co., 5046 Lakeside Ave., Cleveland, Ohio, therefore, has prepared a list of the essential information required. This list was originally published in the *Transactions and Bulletin* of the American Foundrymen's Association, November, 1931, but it has been rearranged and abbreviated to suit the needs of malleable iron customers. The required information is as follows:

1. Sample castings or detailed drawings.
2. Actual weight of the casting, or, if not known, estimated weight.
3. Number of pieces to be ordered from each pattern and approximate delivery dates.
4. Quantities ordered per year from each pattern, and also number usually ordered at one time. The size and frequency of the orders often determine whether to mount loose patterns for machine molding or whether to make special rigging which would lower the cost of production.
5. Description of pattern equipment and its condition, indicating:

(a) Type of pattern: Loose (number of patterns and if suitable for mounting on plate); gated (number on gate); plated (number on plate); or machine, cope and drag (number on equipment).

(b) Material from which pattern is constructed: Wood; brass; aluminum; white metal; or iron.

(c) Number of cores per casting, with kind and type of core-boxes: Number of cores to each box; material from which core is made; whether designed for core-blowing machines; and number and kind of core-dryers. All patterns should be painted to accord with standard practice.

6. Drawings should clearly indicate:

(a) Important dimensions, tolerances, and machined surfaces with amount of finish to be allowed.

(b) Special requirements, such as testing, gaging, disk or special grinding, straightening, drilling, drifting, etc.

(c) Special locations, if any, for symbol numbers, pattern numbers, and trademarks, and whether raised or sunken symbols are preferred.

7. Description of the service or use of the castings. If the castings are to be subjected to pressure, give test to be made and methods of making.
8. State whether pound price or piece price is desired. Price is based on a certain weight; if, after making the castings, the weight proves different from that given, the correct weight will be used in refiguring the piece price.
9. Indicate any special crating, marking, or packing.
10. Describe any special finish, such as galvanizing, sherardizing, plating, etc.
11. Describe any previous difficulty encountered with the castings. Information of this kind helps to eliminate trouble, and, in addition, the foundry may be able to make suggestions concerning changes in design to overcome the trouble.

* * *

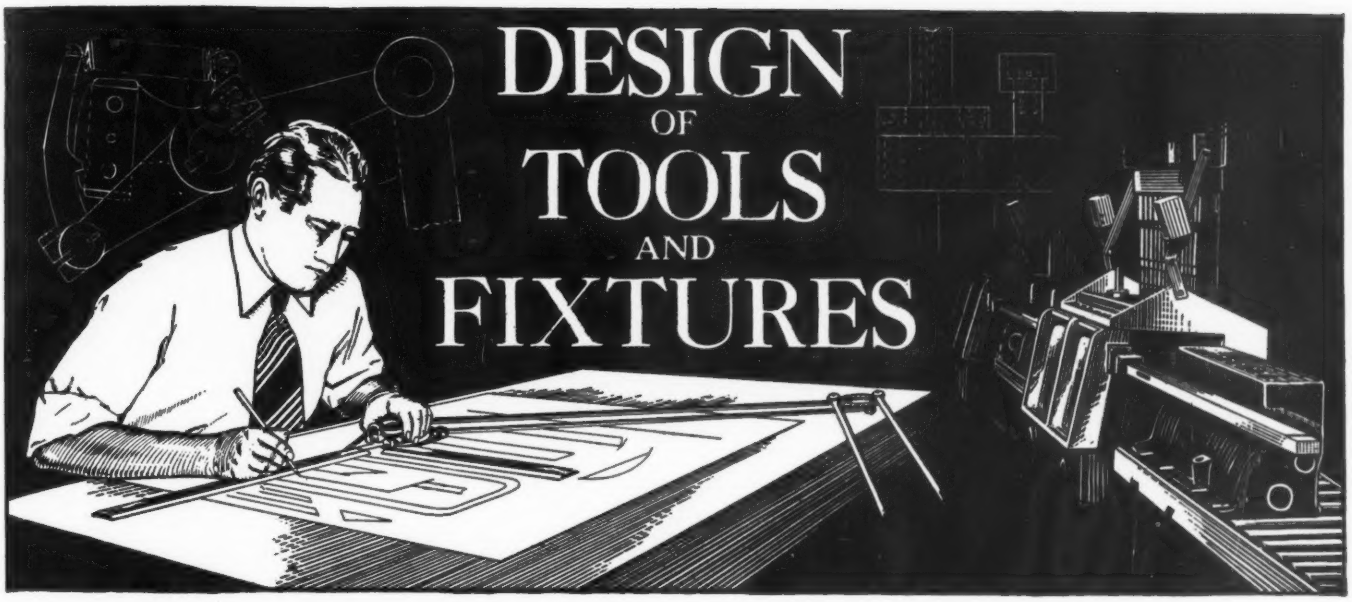
Motion Picture Film Tells the Story of Nickel

The production and application of nickel is depicted in a new two-reel silent educational motion picture film recently prepared under the supervision of the United States Bureau of Mines. The film shows the mining of nickel ore, the crushing, pulverizing, and smelting, as well as electrolytic refining and casting. It further portrays the increased importance of nickel alloys, chiefly those with iron, steel, and copper, and ends with several scenes showing how nickel is utilized in industry and in the home. Copies of this film in 16- or 35-millimeter sizes are loaned for exhibition purposes to clubs and associations upon application to the Pittsburgh Experiment Station of the United States Bureau of Mines, Pittsburgh, Pa. No charge is made for the use of the film, but the user is asked to pay transportation charges.

* * *

Plans for Compensating Salesmen

The method of compensating salesmen has always presented a problem in the industries. For this reason, it is of interest to note that the Policyholders' Service Bureau of the Metropolitan Life Insurance Co., New York City, has issued a comprehensive booklet entitled "Selecting a Plan for Compensating Salesmen." This booklet summarizes the results of the plans used by a number of concerns in varied industries. The publication should prove a valuable guide to executives faced with the problem of adopting plans to suit the needs of their particular company. A summary is presented of the advantages and disadvantages of different plans, both of the salary and the commission type.



Special Gaging Equipment for Compressor Crankshaft

By CHARLES C. TOMNEY, Chief Tool Designer
Carrier Engineering Corporation, Newark, N. J.

The gage shown in the accompanying illustrations was built recently in our shop for gaging two different sizes of compressor crankshafts. This gage is of particular interest because it was less expensive to build than most gages used for such work. Pratt & Whitney "Go" and "Not Go" snap and ring thread gages are used for checking the diameters of the main and crankpin bearings and the thread diameter. Fig. 1 shows a crankshaft in place with C-shaped thickness gages *S* and caps *A* in position for gaging a dimension between shoulders at opposite ends of the crankshaft. This particular dimension is held between 20.500 and 20.495 inches.

The width and relative position of each crankpin bearing are next checked with the hinged gages *C* shown in Fig. 2. Two crankpins are checked in one position, after which the shaft is revolved to bring the other two crankpins into line with the gages. The position and width of the center bearing are also checked by means of a hinged gage *D*. After these dimensions are checked, the width gages are swung out of the way and the thickness gages *S* are removed.

The dial indicators are next fastened in place and blocks *E* are adjusted by means of thumb-nuts *F*. The indicators are set to a master gage (not shown) which is simply a shaft fitted to the bearings of the gage and having four round disks ground to a diameter equal to twice the throw of the crankshaft plus the diameter of the crankpin. The indicators are set at zero, and the adjustable blocks *E* clamped in position by the nuts *G*.

To check the throw, the shaft is merely revolved and readings taken on the indicators. If the throw is out an appreciable amount, the error will be

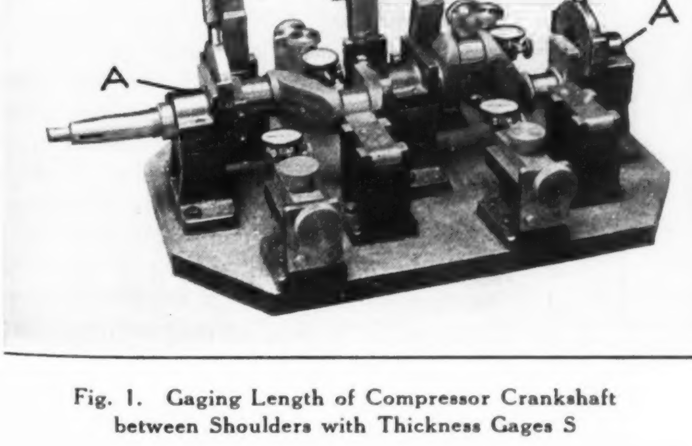


Fig. 1. Gaging Length of Compressor Crankshaft between Shoulders with Thickness Gages S

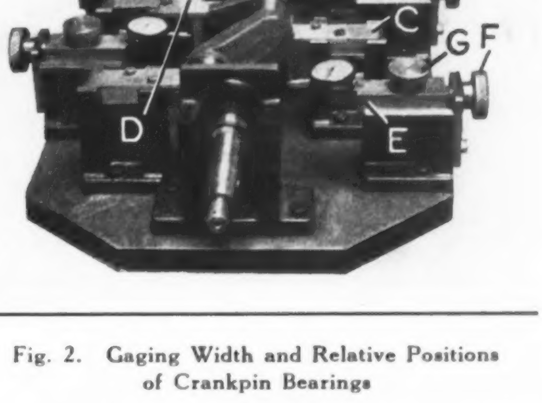


Fig. 2. Gaging Width and Relative Positions of Crankpin Bearings

shown by the indicator. The crankpins are next checked for parallelism by moving the crankshaft endwise and checking as before. The reason for having the thickness gages at each end of the crankshaft is to permit this lateral movement.

A two-throw shaft is also checked with the same equipment. For this shaft, a center bearing is unnecessary, as one end bearing on the shorter shaft is located in the same position as the center bearing on the longer shaft. In checking the shorter shaft, the same procedure is followed, using only two indicators and two width gages.

Dies for Producing Pierced and Formed Parts from Strap Stock

By C. W. HINMAN, Chicago, Ill.

Single-operation progressive dies are made in a great variety of designs for producing such articles as radio parts, telephone switchboard parts, brackets for assembling furniture, and many other similar parts. Often it is difficult to arrive at the best design for a certain part, as for example, the pierced, cut-off, and formed strap shown at *W*, Fig. 1. Five practical designs for dies for producing this part in a single operation were available, in addition to several designs for tool equipment for a multi-slide machine. The progressive die shown in Fig. 1 is used on a punch press. The upper view shows the punch member about to descend and cut off, perforate, and bend the ends of the work in opposite directions. The lower view shows the tool fully closed with all operations completed.

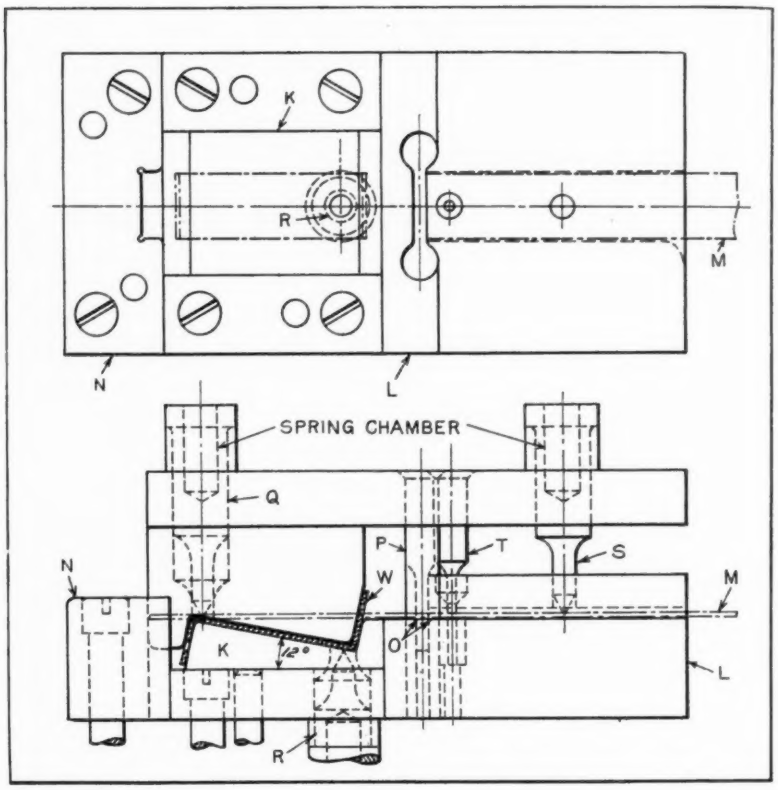


Fig. 2. Die Designed to Produce the Part Indicated at W

The material strip *A* is fed through a channel under the positive stripper plate *B* and across the face of the piercing and cutting-off die-block *C*. When the end of the strip has been pushed through this channel and emerges at the left of the die-block, a continued feeding movement causes it to slide upward on the face of the pivoted forming block *D* at an angle of about 10 degrees, against stop *E*.

Next, the cutting-off and bending punch *F* descends; an adjustable cutting-off blade severs the strip at point *G*; and the punch instantly begins to bend the ends of the work in opposite directions. The bends are made between the punch and block *H* on the left, and between the punch and the pivoted forming block *D* at the right, thus preventing "creep." The fulcrum pin through block *D* has a flattened top and takes none of the forming thrust. Block *D* is supported at all times in the bottom of its confining channel *I*.

As the punch continues to descend and form both ends of the piece simultane-

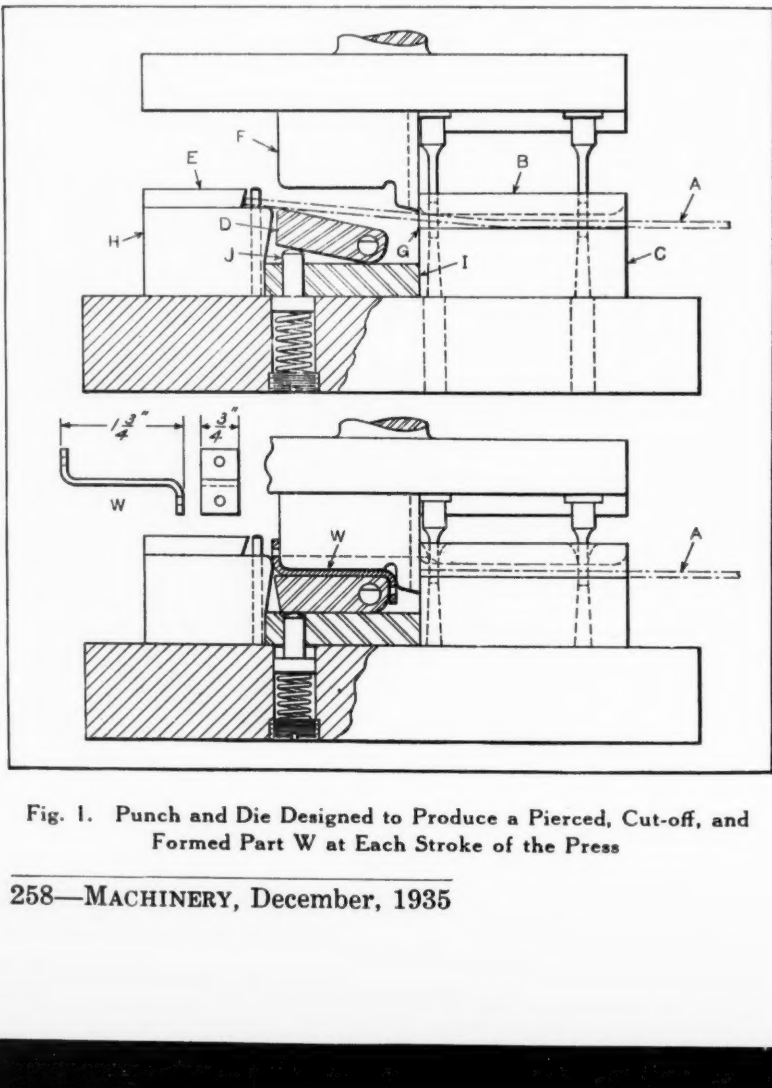


Fig. 1. Punch and Die Designed to Produce a Pierced, Cut-off, and Formed Part W at Each Stroke of the Press

ously, spring-pin J is depressed until block D lies flat in the bottom of its confining channel. The two holes have now been pierced in the second piece, and the first piece is completed, as shown in the lower view.

When the punch ascends, block D follows upward by reason of the release of compression pin J. The work is ejected by the pulling tendency of the punch at both angular ends, and by the stopping action of the forming block when the shoulder on pin J comes in contact with channel I. The press is used in the inclined position, so that the finished work will slide off the die to the rear.

In Fig. 2 is shown a die of different design for producing a similar piece W in one operation by using a positive bending die-block K. The finished work lies between the closed forming punch and die at an angle of 12 degrees from the horizontal, in order to provide bending and releasing clearance for both angles. The high point of the bending block is in the same horizontal plane as the top surface of die-block L.

When the cutting die-blocks of the dies shown in Figs. 1 and 2 are sharpened by grinding, a like amount is ground from the under sides of the forming blocks in order to maintain the same relative heights. The material strip M in Fig. 2 is fed forward under the channel stripper to the stop-block N. The blank is cut to length at point O by the descending punch P, which cuts out a piece of stock 3/16 inch long. A sharp point at the end of spring-pin Q prevents the blank from "creeping" while the ends are being formed. Spring-pin R has a sharp point which furnishes additional insurance against "creeping." Pin R also ejects the finished piece when it is released by the ascent of the forming punch. This pin does not extend upward high enough to interfere with the feeding of the strip. Spring-pin S prevents the strip from "kicking back" and breaking the slender piercing punch T when the stock is severed.

Swaging Dies Supplant Hand-Chasing for Finishing Non-Ferrous Castings

By WILLIAM C. BETZ, Equipment Engineer
Fafnir Bearing Co., New Britain, Conn.

The use of hard steel dies for swaging fine sand castings to produce the desired finish on fancy builders' hardware has largely supplanted the old and costly method of hand-chasing. However, there are still some plants that employ the latter process in the production of fine escutcheons, such as are used for push-plates, large locks, and fancy metal work for homes, hotels, and clubs. In many cases, the sharp lines and burnished finish required on these parts can be obtained at comparatively small cost by striking the sand castings in a die and then buffing them, care being taken not to distort the sharp outlines produced by the die.

This work requires a very powerful press, as it takes approximately 20 tons per square inch to planish a piece of soft bronze. The press must have sufficient capacity to handle the largest parts produced with a good margin of safety; for this reason, a knuckle type press or a high-speed hydraulic press is generally required.

In swaging work of this kind, it is sometimes advisable to strike the work more than once, in order to cause the metal to flow until it fills every part of the die impression. It is understood, of course, that the punch used in most applications of this kind has a hardened flat surface, although a formed punch may be used if the design is such that too much metal would be wasted in case the work were struck without reducing the whole piece to a uniform thickness, as in the case of highly raised designs.

Paraffin, oil, or a soluble oil solution should be used to lubricate the work in swaging soft metals. The work should be brushed very lightly with the lubricant. An oil containing sulphur should not be used, as it will discolor non-ferrous metals, especially brass and bronze, causing them to turn black. Too much or too heavy a lubricant must also be avoided, so that the flow of the metal into the finer impressions of the die will not be retarded.

At first thought it might seem more economical to form such work from sheet metal. However, it is next to impossible to fill out the fine sharp impressions when work of this class is formed from

Sand-cast Non-ferrous Escutcheons Finished by Striking in Hardened Steel Swaging Dies

sheet metal. The cost of dies for swaging purposes is much less than that of dies for forming parts of the same design from sheet metal. The accompanying illustration shows three examples of sand-cast work finished by striking with a hardened steel die.

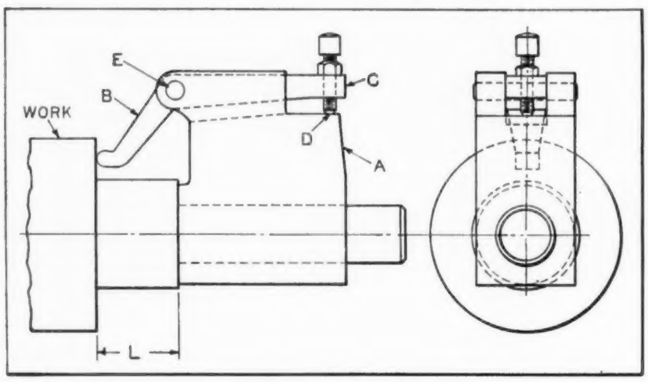
Gage for Checking Shoulder Length on Stud

By J. B. BOOTH, Bradford, Yorkshire, England

The gage here illustrated has proved very satisfactory for checking the length *L* of the shoulder on a stud. This gage is simple, both in design and operation; it gives a visual record of errors, and also permits the use of feeler gages to determine the exact amount of the error. The base *A* is simply a steel block of the shape shown, with a drilled hole in which the stud fits snugly. The face in contact with the shoulder is ground square with the hole.

The movable gaging member, which is free to swivel about the fulcrum pin *E* in the base, has a short arm *B* which contacts with the work and a long arm *C* which is fitted with a set-screw and lock-nut. The set-screw is adjusted to just make contact with the base at *D* when the length *L* of the shoulder is correct. The end of the set-screw is hardened and ground flat to contact accurately with the face on the base, which is also ground flat.

In using this gage, the base is placed on the stud as shown, and pressed forward until the end is in contact with the first shoulder on the stud. The movable arm *B* then makes contact with the second shoulder. If the length *L* is too short, the end of the lock-nut will leave the base at *D*. As the lengths of arms *C* and *B* are in the ratio of 2 to 1, the gap at *D* will be twice the amount of the error and can be readily seen, or it can be measured with feeler gages. If the shoulder length *L* is too long, there will be a gap between the contact end of arm *B* and the work when the set-screw is in contact with the base at *D*. This gap can also be measured with feeler gages to determine the amount of error.

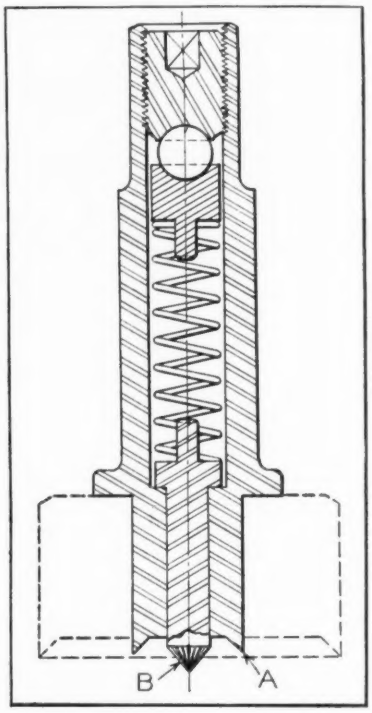


Gage for Checking Length L of Shoulder on Stud

Tool for Cutting Holes in Thin Sheets

By WILLIAM M. HALLIDAY
Baildon, Yorkshire, England

The tool shown in the accompanying illustration was designed to overcome the difficulties experienced in drilling thin sheet material with an ordinary twist drill. When an ordinary drill is used for such work, it is seldom possible to produce a hole that is truly round or that has smooth, clean-cut edges. This is especially true when the softer materials are drilled. There is also danger of the tool catching and tearing the material, or causing it to whirl around and injure the workman. These troubles are practically eliminated with the tool shown.



Tool for Cutting Round Holes in Thin Sheets

The cutting tool itself has evenly spaced teeth at *A*, which produce the hole by cutting out a disk, similar to trepanning. The shank of the tool is held in the drill chuck, and the rotating tool is fed downward, the same as a twist drill. Center-punch marks are made in the material at the points to be drilled, and the work is located for drilling each hole by means of the center *B* in the tool.

The center *B* recedes, compressing the spring in back of it when the tool is fed into the work. The hardened steel ball in the cavity of the socket screw at the upper end of the tool allows the spring and its bearing plug, as well as the center *B*, to remain stationary while the cutter revolves. The chamber containing the spring may be filled with grease to provide lubrication for the bearing surfaces. For drilling, or rather trepanning, larger holes, a cutter such as shown by the dotted lines is slipped over the shouldered end of the tool and secured in place by a set-screw. When the hole is completely drilled, the center plug is forced downward by the spring. This action serves to strip any adhering chips or pieces of metal from around the hole, leaving the edges smooth and clean-cut.

* * *

Simplicity is likely to be the keynote in machine design during the next few years.

Machining Pistons for the New Buick

Specially Equipped Automatic Lathes, Multiple-Station Indexing Type Drilling Machines, Precision Boring Machines and Precision Gaging Devices are Important Units in Buick's New Piston Production Line

AN entirely new piston machining and inspecting line has been installed at the Buick plant for the production of Anolite pistons for the 1936 model cars. The latest type production equipment has been incorporated in this machining line to assure accuracy in manufacture and efficient production. The efficiency of this equipment has been enhanced by the use of cemented tungsten-carbide and diamond cutting tools. A machine on which the pistons are automatically machined to the correct weight is another interesting feature.

In production, the pistons are chucked internally for the first operation, which consists of cutting off the piston to length, centering the head end and counterboring the open end to receive the locating center of an automatic lathe. These centers are used for locating the work throughout the following machining operations: Rough-turning; facing the head; rough- and finish-machining the ring groove; chamfering the head lands; rough- and finish-turning an expansion groove in the head lands; and chamfering the head and skirt end of the piston. All these operations are performed in a single set-up on a Fay automatic lathe with multiple tooling, all tools being tipped with cemented tungsten-carbide.

Special Drilling Machines Perform the Various Drilling Operations

Following these operations the pin-holes are rough- and finish-bored on double-head Kingsbury high-speed drilling machines, the work being located from the head-end center. A hand reaming operation on the pin-hole for sizing follows, accurate size control being required for locating the work properly on the machine employed for a cam grinding operation, by which the slotted skirt side of the piston is ground somewhat higher than the pressure side.

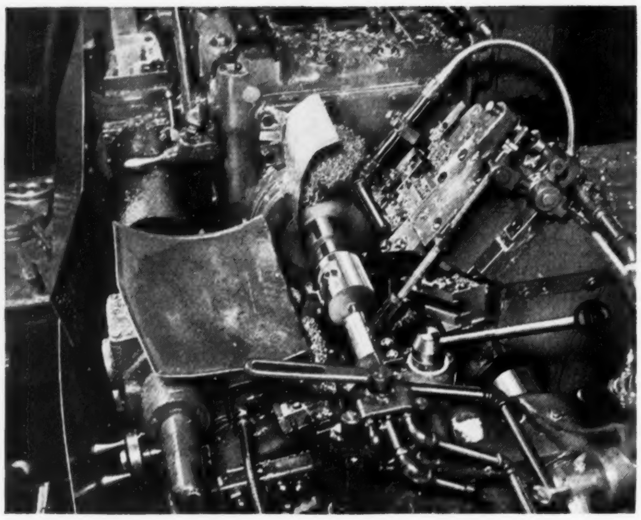
Since two oil-rings are used in the new Buick pistons, both the lower grooves must be drilled for oil relief. This is done on Kingsbury multiple-station machines provided with indexing fixtures. In these fixtures, the pistons are located by the open-end center and the pin-hole. The latter means for positioning must be employed, since two of the oil-holes in the lower ring groove must match or connect with oil-holes to be drilled through the pin bosses for positive lubrication of the pin bearing in the piston. The oil-holes through the pin boss are next drilled on a two-spindle drilling machine, after which all holes are inspected for burrs.

Multiple-Station Machines for Milling and Drilling

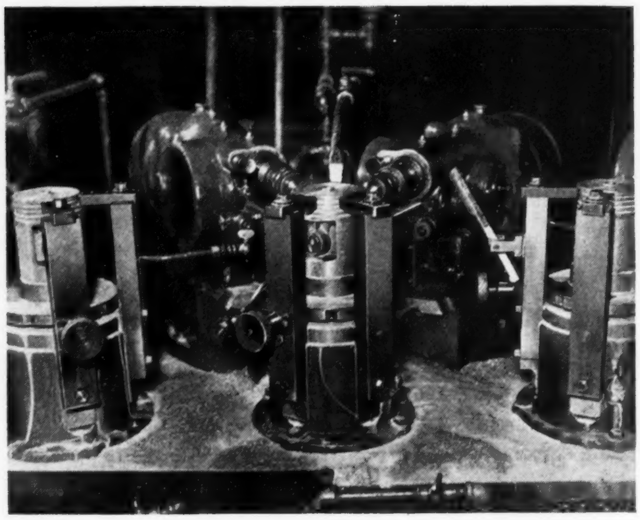
The next operation consists of drilling relief holes at the end of the T-slots in the piston skirt, etc., and milling both the T-slot and circumferential slot on the pressure side of the skirt. These operations are all performed in one set-up on Kingsbury multiple-station machines equipped with indexing fixtures, six stations being used for these miscellaneous operations.

The pistons travel around twice on the indexing table, the first time for operations on the T-slot side, the second time for operations performed on the pressure side. Cams in the piston-holding fixtures prevent operation at some of the stations—as for example, the station for milling the vertical skirt slot, when work is being done on the pressure side. Thus, in addition to indexing the fixture-holding table from station to station, the individual fixtures are indexed automatically to permit the following operations to be performed on both sides of the work.

The open-end bores of the pistons are now re-centered in order to remove any burrs and permit accurate locating of the work in the grinding ma-



Rough- and Finish-turning Buick Pistons in Automatic Lathe with Tools Tipped with Cemented Tungsten-carbide



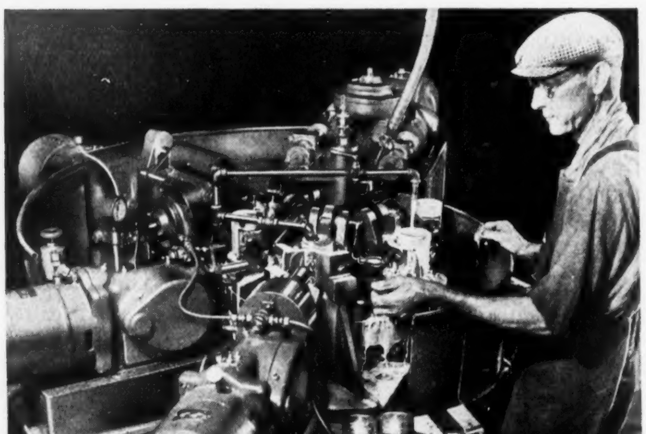
Drilling Accurately Located Holes in Two Lower Ring Grooves of Pistons on a Double-head High-speed Drilling Machine

chines on which rough- and finish-grinding operations are performed. A recentering of the open end of the work is necessary between the two operations. The location for indexing is from the pin-hole. The slotted side of the piston is cam-ground 0.0006 to 0.001 inch higher than the pressure side to insure a proper fit in the cylinder for obtaining uniform skirt pressure around the entire surface of the cylinder. After these grinding operations, the piston-heads are spot-faced on a hand drilling machine.

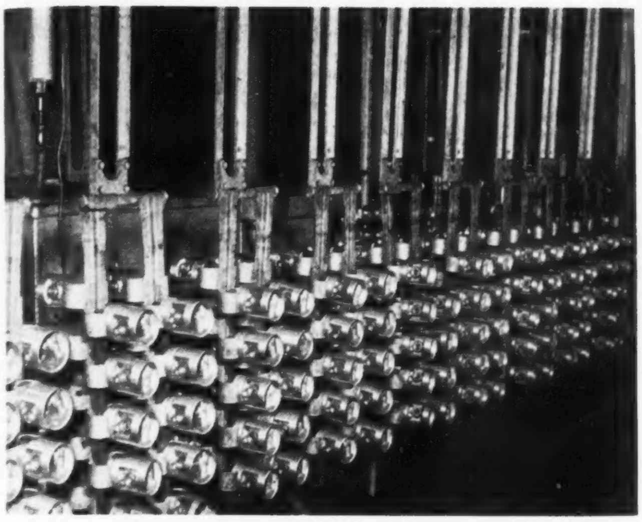
The next operation consists of counterboring the pistons to standard weight. For this operation, the pistons are mounted in a floating fixture located on the arms of a weighing scale. The heavier the piston, the more the arms will be depressed. The arms and fixture are then locked in whatever position they have reached, the locking hand-lever serving to start a counterboring cutter which feeds upward into the piston bore. This cutter always cuts to exactly the same height, so that the depth of cut taken depends on the vertical position of the piston, as automatically predetermined by the amount the piston is over weight.

The cutter used for this operation is withdrawn automatically, releasing the fixture and piston. The arms readjust themselves to a new level, so that a direct check is available as to whether the piston has been machined to exactly the right weight by simply reading the scale. In actual operation, however, this check is mainly useful as a guide to determine cutter wear, since the machines

Drilling Slot-end Holes and Milling the Slots in Pistons on a Multiple-station Drilling Machine Equipped with Indexing Fixtures



Pistons are Brought to Uniform Weight by a Fixture that Automatically Locates them for Removing the Required Amount



The Anodizing of Buick Pistons on a Production Basis is Handled Automatically by Conveyors

Device for Measuring Thickness and Hardness of Anodic Coating on Pistons by Sandblasting Method

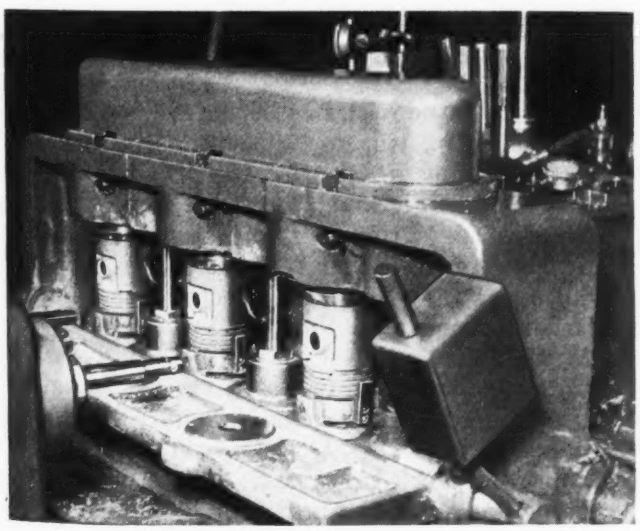
are so adjusted as to consistently and accurately bore out the right amount of material for each piston.

Next the pistons go to the anodizing installation, where the surface metal is electrolytically changed to a hard oxide, a development that has resulted in tremendously increasing the life of alloy pistons and that is one of the main features making possible the adoption of such pistons on the new car. The anodizing process is, in effect, a "deplating" one. Instead of depositing material on the piston, the electric current in the bath is reversed, changing the surface metal to a hard oxide and thereby greatly increasing the life of the piston.

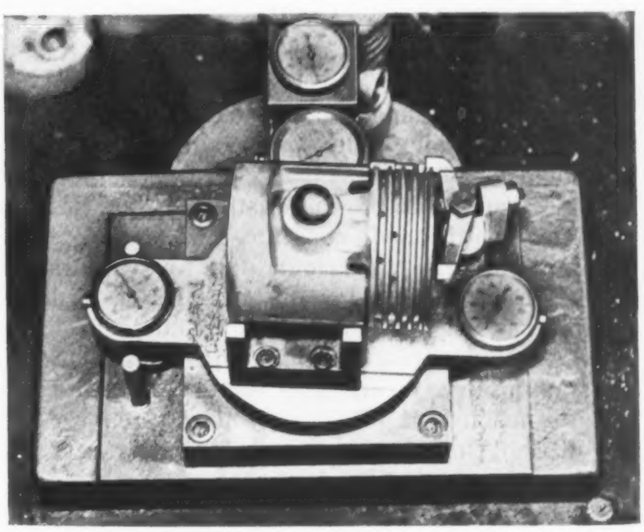
In carrying out the anodizing process, the bath is required to be held to a uniform temperature within plus or minus one degree F. The water supply for controlling the temperature is contained in a tank inside the U-shaped tank containing the anodizing bath. The water supply for this cooling bath comes from a special well sunk for the purpose to a depth of 354 feet to assure an adequate water supply of constant temperature. The water from this depth is, of course, almost ice cold. It was found that the variation in the temperature of the city water supply system did not give sufficiently close temperature control.

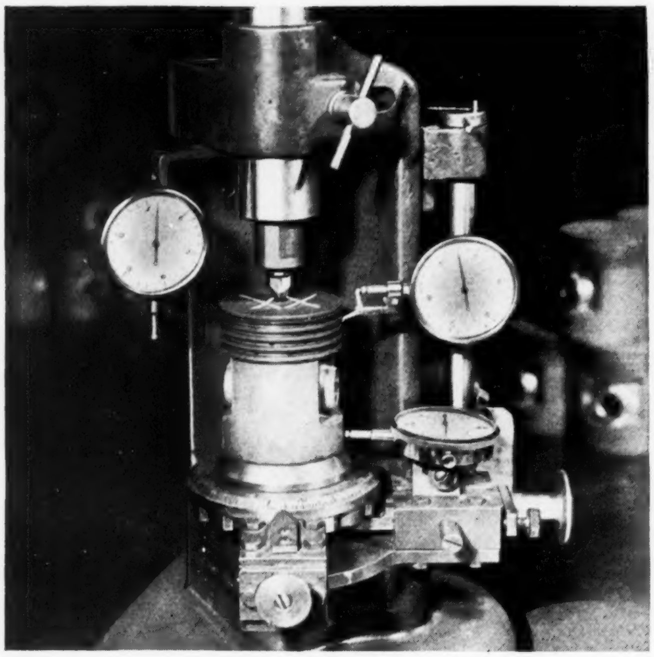
The non-conductivity of the oxide surfaces on the pistons produced by the anodizing process makes possible the use of an ingenious method for checking or determining the hardness or thickness of the anodic coating on the piston. Sample pistons

Three Piston-pin Holes are Finish-bored Simultaneously by Tungsten-carbide Tools and Final Finish-bored by Diamond Tools

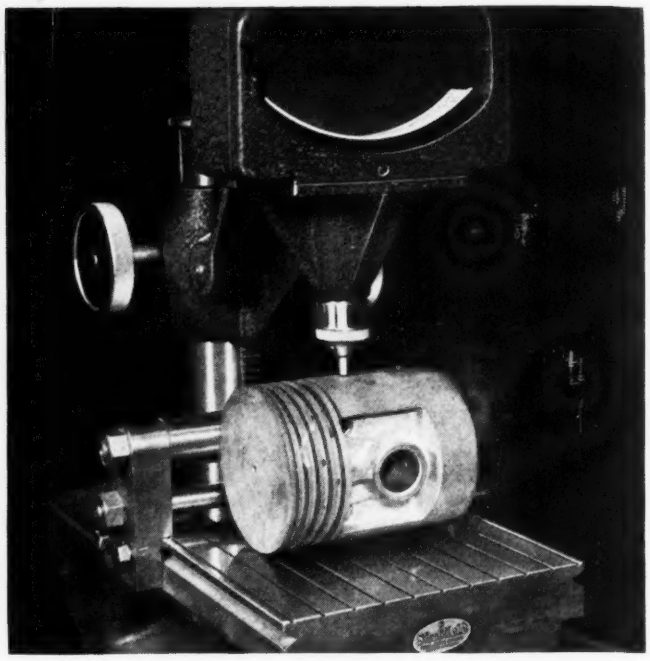


Multiple Gage for Simultaneously Checking Over-all Length of Piston, Alignment of Piston-pin Hole, and Centering of Hole in Piston





Multiple Gage for Obtaining Several Piston Measurements, Including Measurement of the Eccentricity of the Ring Grooves



For Inspection Operations Such as Checking the Cam-ground Skirts of the Pistons, a Very Sensitive Mirror Gage is Employed

are mounted in a fixture enclosed within a specially designed sand-blast machine. Contacts are placed across the skirt of the piston in series with a special current supply and an electric lamp. The sand blast is turned on and the time required for the special grit to cut through the coating is measured, an electric circuit being established which will light the lamp when the coating is cut through. The time required is a direct measure of the combined hardness and thickness of the coating.

After the anodizing operations, the finishing of the piston-pin holes is accomplished on double-head horizontal borers, several of which are grouped as one machine and operated simultaneously. The pistons are mounted in the center and semi-finish boring tools tipped with tungsten carbide are run through the piston-pin holes. The tungsten-carbide tools are then withdrawn and diamond-point boring tools on the opposite side of the fixture are fed through the holes to give them a final finish. The fixtures are self-aligned and the pistons are positioned in the fixture by pins inserted in the index-holes, after which the fixture is locked.

Final inspection of the pistons is carried on in an air-conditioned, constant-temperature room to eliminate any variations due to temperature changes from day to day. A number of interesting fixtures are employed for the final checking; one of these fixtures, equipped with multiple arms and four gages, is employed for checking the pistons for alignment of the pin-holes, etc., for the over-all length, and for the correct height of the hole from the piston-head. Another inspection fixture is equipped with two gages for checking the piston-ring grooves for eccentricity, width, and depth. Both of these means for checking are applied to all the pistons produced.

Inspection of the pistons for accuracy of the outside diameter and the width across the cam-ground faces, etc., is accomplished on a special fixture provided with mirror amplifiers which throw a shadow of the pointer against an enlarged dial, thereby providing easier and more accurate reading of the gage. The pistons are grouped in eight sizes, graduated in steps of 0.0003 inch on the outside diameter. A number corresponding to the size of the piston is stamped on the piston-pin boss to prevent any possibility of error in the final assembly of the pistons in an engine.

* * *

Facilitating the Selection of Silent Chain Drives

An interesting device has been developed by the Morse Chain Co., Ithaca, N. Y., to assist users of silent chain drives in selecting the proper drive for any specific installation. The device consists primarily of three cardboards with tabulations, one sliding between the other two. The device makes it a simple matter to properly select any chain drive within the range of 1/2 to 150 horsepower. It selects the number of teeth in the sprockets and the pitch and width of the chain; gives the standard center distance; figures the chain length; gives the diameters of the sprockets; and even indicates the sizes that are carried in stock. It is a device useful to all who select chain drives.

The Grinding of Milling Cutters*

A Detailed Review of the Methods Used in Grinding Different Types of Milling Cutters with a View to Obtaining the Best Results in Milling Operations—First of Two Articles

By A. H. PREY, Sales Research Department
The Carborundum Company, Niagara Falls, N. Y.

A DULL milling cutter deteriorates rapidly, slows up production, and makes necessary the grinding away of a large part of the teeth to bring it back into condition. A frequently sharpened cutter removes metal rapidly, and, when sharpened, the amount of stock removed for reconditioning is small. Frequent grinding is necessary in the economical use of milling cutters.

As far as grinding methods are concerned, milling cutters are of two types: (1) Cutters that are sharpened on the periphery by grinding at an angle behind the cutting edge. The clearance angle is produced by the grinding operation. This class includes milling cutters with straight and spiral teeth, side milling cutters, face mills, end-mills, etc. (2) Cutters that are sharpened by grinding the front faces of their teeth. These cutters have a definite profile for producing a given form, and are generally known as formed or relieved cutters. The clearance is produced by the relieving operation when the cutters are made. This class includes gear-cutters, formed cutters, etc.

Two Methods of Cutter Grinding

There are two methods of grinding cutters and reamers, based upon the direction of rotation of the grinding wheel relative to the cutting edges. As shown in Fig. 1 at *A*, the grinding wheel rotates away from the cutting edge. The rotation of the wheel holds the cutter on the tooth-rest, but the wheel raises a burr on the cutting edge which must be removed by stoning and has a tendency to draw the temper. At *B* the wheel rotates toward the cutting edge. In this case, there is less danger of burning the tooth, but great care must be used to hold the cutter against the tooth-rest.

Cup-wheels are used for grinding cutters as shown at *C* and *E*. The same statements with regard to the direction of the wheel motion as were made in regard to regular wheels apply here. More care, however, should be taken in using cup-wheels, because of the greater area of contact between the wheel and the work. The cuts should be light.

In general, a plain wheel may be used on narrow lands, but a cup-wheel should be used on wide lands, as it produces a flat or straight land. A plain wheel may, however, be tilted by swiveling the wheel-head, so that the cut will approach a straight line. Plain wheels are sometimes used on cutters up to 4 inches in diameter, while cup-wheels are used for larger sizes. In Fig. 2, at *A* and *B* are shown, in an exaggerated manner, the clearance produced by plain and cup-wheels. It will be noted that, in using a plain wheel, the actual angle at the cutting edge is much greater than the apparent angle. The apparent angle must be large enough so that the heel of the tooth will not drag on the work when the cutter is used.

Correct clearance back of the cutting edge is essential. Insufficient clearance causes the teeth to drag over the work, while too much clearance

*Abstracted from a forthcoming book on tool-room grinding, to be published by The Carborundum Company, Niagara Falls, N. Y.

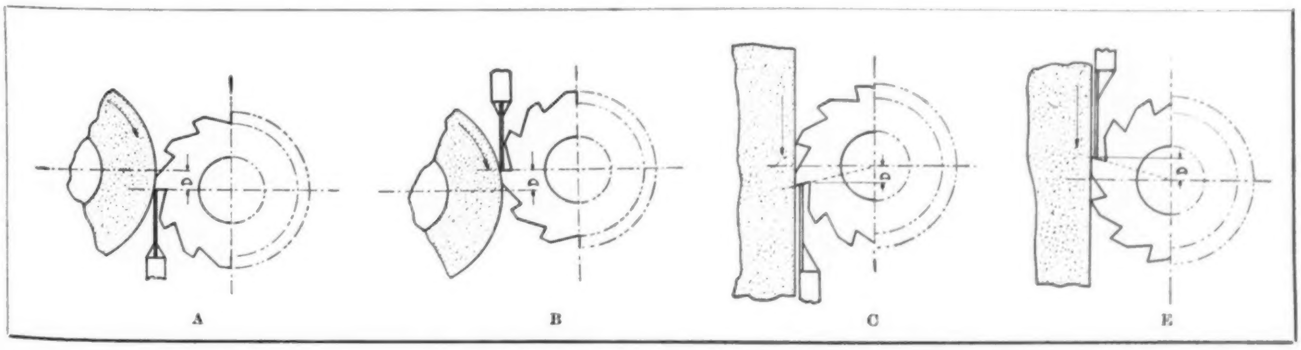


Fig. 1. The Setting of Tooth-rests for the Grinding of Milling Cutters

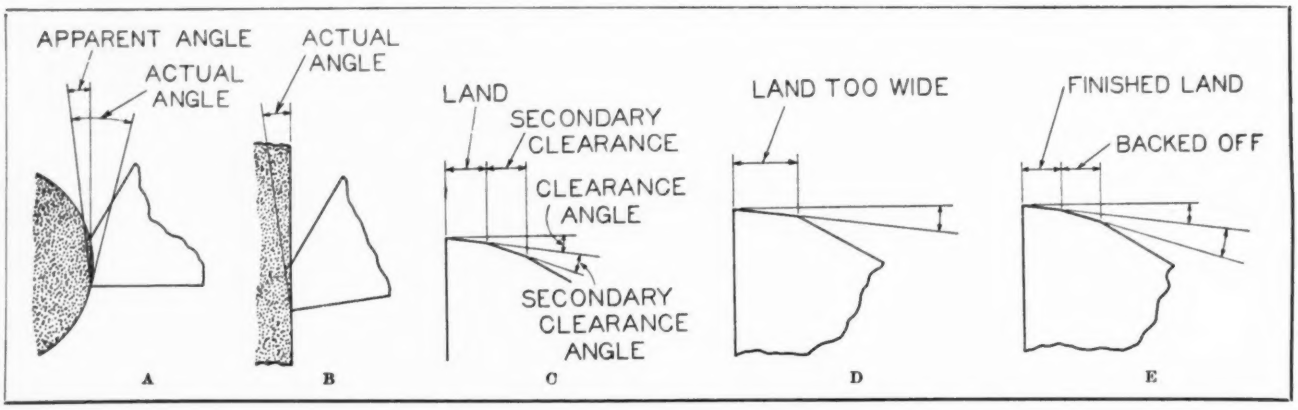


Fig. 2. Grinding the Land of Milling Cutters

causes chatter and rapid wear. Too much clearance is less objectionable than too little, however. The edge must be sharp and the clearance angle correct. A secondary clearance of from 9 to 30 degrees, depending upon the design, produces a stronger tooth and makes it easy to control the width of the land, which should be about 1/32 to 3/64 inch. When the land becomes too wide from many sharpenings, a secondary clearance may be ground, to narrow the land to the correct width. (See *C*, Fig. 2.)

The proper clearance angle must be determined by experience. The following table, recommended by the Cincinnati Milling Machine Co., may be used as a guide for general practice:

	Degrees
Ordinary Low Carbon Steel	0 to 7
Hard Steel	2 1/2 to 5
Steel Castings	6 to 7
Cast Iron, Fast Feeds	3 to 7
Bronze, Cast	10 to 15
Tobin Bronze, Very Tough	4 to 7
Copper	12 to 15
Aluminum	10 to 12

The angles given are for average cutters. For large cutters, they may be reduced slightly, and for small cutters they may be increased.

The clearance angle is obtained by properly locating the wheel, the cutter, and the tooth-rest. With a plain wheel, the clearance angle depends on the diameter of the wheel, while with a cup-wheel, the diameter of the cutter is the determining factor. In general, the center of the wheel and the work are brought into the same plane with the tip of the tooth-rest by adjusting the table or the wheel-head, or both, and the tooth-rest and cutter are set to give the desired clearance. A center gage is used to line up the wheel, cutter, and tooth-rest in the same plane.

When a plain wheel is used, the cutter center, the wheel center, and the tooth-rest (mounted on the table) are brought into the same plane by using the center gage, and the tooth-rest and table are lowered or raised, as indicated at *A* and *B*, Fig. 1. When a cup-wheel is used, the cutter center, the wheel center and the tooth-rest (here mounted on the wheel-head) are brought into the same plane, and the wheel-head lowered or raised to give the required clearance, as shown at *C* and *E*. The distance the cutter or wheel is moved is represented by *D*. Some machines have dials on the work-head which are graduated in degrees, so that the setting of the cutter is quite simple. Others have a system of gears in the work-head for giving the correct angle and automatically indexing each tooth as the grinding proceeds. The accompanying tables show tooth-rest settings for different angles.

Rules for Setting the Cutter for Grinding

To determine the setting of the cutter when a plain wheel is used, multiply the clearance angle, in degrees, by the wheel diameter, in inches, by 0.0088. The result will be the distance in thousandths of an inch to raise or lower the cutter and tooth-rest (mounted on the table) to obtain the correct clearance.

When a cup-wheel is used, the setting is obtained by multiplying the clearance angle, in degrees, by the cutter diameter by 0.0088.

The following rules apply to the raising and lowering of the wheel-head.

When the Tooth-Rest is Mounted on the Wheel-Head—(1) Cup-Wheel: The wheel-head is raised or lowered with no adjustment of the tooth-rest. *(2) Plain Wheel:* The wheel-head is raised or lowered, but the tooth-rest must be brought in line with the center of the cutter.

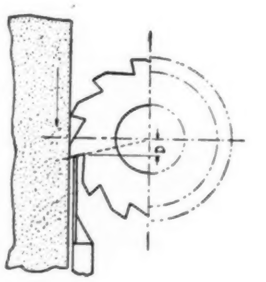
When the Tooth-Rest is Mounted on the Table—(1) Cup-Wheel: The wheel-head is raised or lowered to avoid grinding on the tooth next to the one being sharpened, and the tooth-rest set the required amount. *(2) Plain Wheel:* The wheel-head is raised or lowered the required amount, but the tooth-rest must be kept in line with the center of the cutter.

The movement between the wheel-head and the table is only relative. The same effect is produced by raising or lowering the table and not moving the wheel-head.

The tooth-rest is generally fastened to the table when tapered cutters and reamers with straight teeth are being ground, so as to produce the same clearance angle throughout the length of the tooth.

Setting Tooth-Rest when Using Cup-Wheels

For Setting Tooth-Rest to Obtain 5 Degrees and 7 Degrees Clearance when Grinding Peripheral Teeth of Milling Cutters with a Cup-Wheel. All Dimensions in Inches.



Cutter Diameter	D for 5°	D for 7°
1/2	0.022	0.030
3/4	0.033	0.045
1	0.044	0.060
1 1/4	0.055	0.075
1 1/2	0.066	0.090
1 3/4	0.077	0.105
2	0.088	0.120
2 1/2	0.110	0.150
2 3/4	0.121	0.165
3	0.132	0.180
3 1/2	0.154	0.210
4	0.176	0.240
4 1/2	0.198	0.270
5	0.220	0.300
5 1/2	0.242	0.330
6	0.264	0.360

The tooth-rest must be fastened to the wheel-head when spiral milling cutters on centers are being ground, except if the set-up is such that the cutter is free to revolve and move longitudinally on the arbor, when the tooth-rest may be fastened on the table. When the tooth-rest is fastened to the wheel-head, the setting must be such that the cutter will pass off the wheel before it passes off the tooth-rest. In grinding spiral milling cutters, the tooth-rest must be set to follow the angle of the spiral.

Instructions for Sharpening Milling Cutters

In general, the following method is used in sharpening milling cutters. The cutter is set on an arbor, and the tooth-rest, wheel, and work centers are adjusted to give the required clearance. The work is brought to the wheel until sparks indicate contact. Then the cutter is passed back and forth, with the one tooth barely touching the wheel. The tooth should now be inspected to see if the machine is properly set to follow the old clearance. It is good practice to grind two adjacent teeth, rotate the cutter, grind two teeth on the opposite side, and then measure across two opposite teeth to check the straightness of the machine setting. Each tooth is traversed past the wheel with a steady motion, taking light cuts. To avoid drawing the temper, the cuts should not be over 0.002 inch deep, and too high a wheel speed or too hard a wheel should not be used. Especially light cuts should be taken in using a cup-wheel. The same amount should be ground from each tooth to maintain all the teeth at an equal height. If the wheel wears in going around the cutter, the last tooth ground will be high. To prevent this trouble, the cutter should be gone around twice, starting the second time 180 degrees from the first start and taking very light cuts. The mandrel or arbor on which the cutter is mounted must be straight and round, and the hole in the cutter must be accurate.

In grinding spiral milling cutters, the tooth-rest is tilted to align it with the spiral on the teeth, with a slight relief on the "following" corner. The tooth-rest should be flat on top, except on the corner, and a little wider than the grinding wheel to allow the cutter to pass the wheel when indexing to the next tooth.

When the lands of the teeth become too wide from frequent grinding, as shown in Fig. 2 at *D* and *E*, the following procedure may be used: 1. Sharpen by grinding the land to the required clearance angle. 2. Grind a secondary clearance to bring the land to the correct width.

Grinding Wheel Speeds

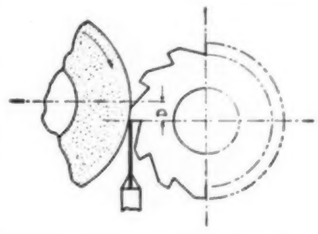
Since different sizes of grinding wheels are used for tool and cutter grinding, it is important that the operator change the speed of the wheel in revolutions per minute when changing wheels, so that the correct peripheral speed of the wheel may be maintained. Too high speeds make wheels act harder, and too low speeds make them act softer. Frequently, the operator can change the wheel speed so as to be able to use wheels that are not actually suited for the work. Thus, if the wheel acts hard, the wheel speed may be reduced and vice versa. Grinding wheel manufacturers are in a position to recommend the proper kind of wheel to be used for different requirements.

* * *

In spite of the unsupported claims made to the contrary, statistics show that a larger proportion of the total population of the United States is today employed in producing goods and rendering industrial services than in the times when there was less machinery and more hand labor.

Setting Tooth-Rest when Using Plain Wheels

For Setting Work Center and Tooth-Rest Below Center of Wheel to Obtain 5 Degrees and 7 Degrees Clearance with Wheels of Different Diameters when Grinding on the Periphery of the Wheel. All Dimensions in Inches.



Wheel Diameter	D for 5°	D for 7°	Wheel Diameter	D for 5°	D for 7°
2 1/4	0.094	0.125	4 1/4	0.176	0.250
2 1/2	0.099	0.141	4 1/2	0.187	0.265
2 3/4	0.110	0.156	4 3/4	0 198	0.281
3	0.125	0.172	5	0.209	0.297
3 1/4	0.132	0.187	5 1/4	0.220	0.312
3 1/2	0.143	0.203	5 1/2	0.231	0.328
3 3/4	0.154	0.219	5 3/4	0.242	0.344
4	0.165	0.234	6	0.253	0.359

NOTE: If the grinding wheel is so large that it strikes the next tooth, a smaller wheel should be chosen and the centers readjusted so as to be correct for the new diameter.

Cemented-Carbide Cutting Tools in Present-Day Shop Practice

By ROGER D. PROSSER, Thomas Prosser & Son, New York City

The Results of an Extensive and Thorough Inquiry into Current American Shop Practice in the Use of the Recently Introduced Cutting Tools are of Marked Interest to Production Men

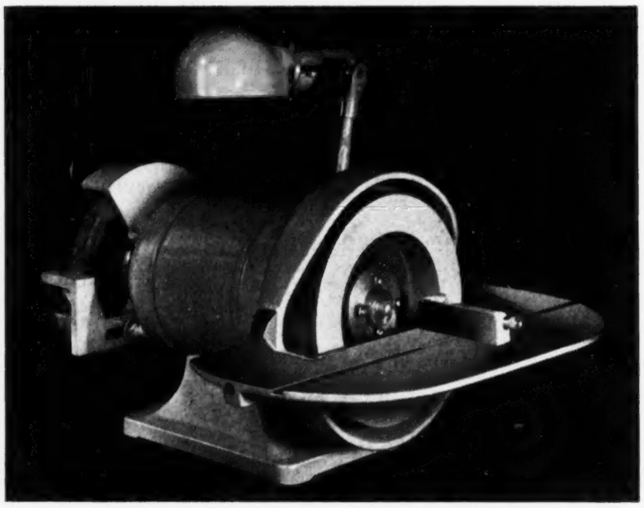


Fig. 1. A Tool Grinder Adapted for the Use of Cemented-carbide Tools. The New Diamond Wheels May be Used if Desired

THE Sub-committee on Metal Cutting Materials of the Special Research Committee on the Cutting of Metals of the American Society of Mechanical Engineers has issued its 1935 Progress Report. This report was referred to on page 167 of October MACHINERY. The present article is intended to bring out briefly some of the important facts contained in the report. The complete report can be obtained from the American Society of Mechanical Engineers, 29 W. 39th St., New York City. This report is the third of a series of surveys on the application of cemented-carbide and other cutting materials undertaken by the committee.

When the first of these surveys was made in 1930, it was found that, on the average, considerably less than one per cent of all tools used were tipped with cemented carbide. In 1931, a similar survey indicated that approximately 5 per cent were tipped with the new cutting material. The present survey shows an average of nearly 8.5 per cent made from cemented carbide, a marked increase. This figure is based on an average of all the replies received to a questionnaire, and includes those who do not use cemented-carbide tools, as well as those who do. If only those who make use of the material are considered, the average is about 10.5 per cent of all the tools in these plants.

Another interesting fact brought out by the questionnaire is that, among progressive concerns who use the more recent cutting materials, an average of nearly 50 per cent of all the tools used are either cobalt high-speed steel, cemented carbide, or Stellite. This indicates that the more recently developed cutting materials occupy a very important place in industry, and that those who have thoroughly studied their use are able to employ them to advantage for a very large number of applications.

The field for the cemented carbides is constantly widening. In addition to the ordinary lathe and boring mill tools, large numbers of milling cutters, counterbores, reamers, spot-facers, multi-diameter cutters, drills, and other types of tools fitted with cemented-carbide cutting edges are being used. In addition, the material is used for many non-cutting applications. Wear resistance is obtained by facing many machine parts with cemented carbide, such as centerless-grinder rests, spring-forming guides, gages, etc.

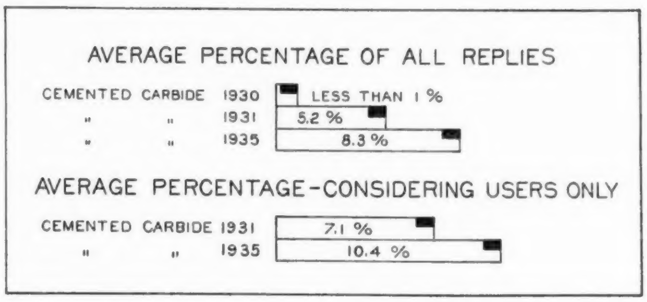


Fig. 2. Comparative Growth in the Use of Cemented-carbide Tools in American Industry

The use of cemented carbides for machining steel has increased, due to the recent improvements in cutting tool materials that increase resistance to wear and "cratering" on the top surface of the tool. A considerable percentage of the replies received made mention of the successful use of carbide tools on various kinds of steel, and some astonishingly high cutting speeds were recorded.

The average increase in production obtained through the use of cemented-carbide tools in machining steel was about 35 per cent. For cast iron, the increase averaged about 60 per cent. The fact that the increase in production on steel is less than on cast iron is doubtless due to lack of sufficient power and speed in the machine tools used. On machines having plenty of power and speed, even greater increases are possible than have yet been obtained on cast iron. It is believed that the answers indicate that the benefits of cemented-carbide tools are not being fully obtained by most users.

The Grinding of Cemented-Carbide Tools

The average length of time required for grinding the tools indicates that much time is lost in this operation. Apparently, in many shops the tools are set up on surface grinders to obtain the correct angles, because no suitable grinder especially designed for this work is available. Surface grinding merely for the purpose of accurately maintaining the tool angles is unnecessary and is a waste of time.

It is very simple to grind cemented carbide rapidly with the proper equipment. All that the average shop requires is a simple, rigid, double-end grinder, such as shown in Fig. 1, with a roughing wheel on one end, a finishing wheel on the other, tables which can be set quickly to the correct angle, and a reversing motor. Wet grinding is not necessary if only a few tools are being ground from time to time. However, when any extensive amount of grinding is done, the wet method permits more rapid grinding, better finish, and less danger of cracking the cemented-carbide tip.

The time required for regrinding an ordinary tool was reported as running all the way up to three hours, but the average was between ten and twenty minutes. This is an excessive amount of time for regrinding tools. A good edge and a correct angle can be obtained in from two to five minutes; and if more time is required to regrind the average single-point tool, even if it is chipped, the cause should be determined. Probably it will be found to be the lack of a suitable grinder. The waste of time may also be due to allowing each machine operator to grind his own tools. One man properly trained to do this work can do it better and more rapidly.

Most users of carbide tools grind them complete on silicon-carbide wheels, but the new diamond wheels are coming more and more into use. They cut very rapidly and produce an excellent cutting edge free from nicks. For some purposes they seem to be indispensable. The only drawback is their high first cost, but users claim that this is soon absorbed. It is not necessary for the average shop to buy an expensive machine to use diamond wheels successfully. They can be used on moderate-priced machines having an adjustable table, on oil wick for lubricating the wheel, and a reversing motor.

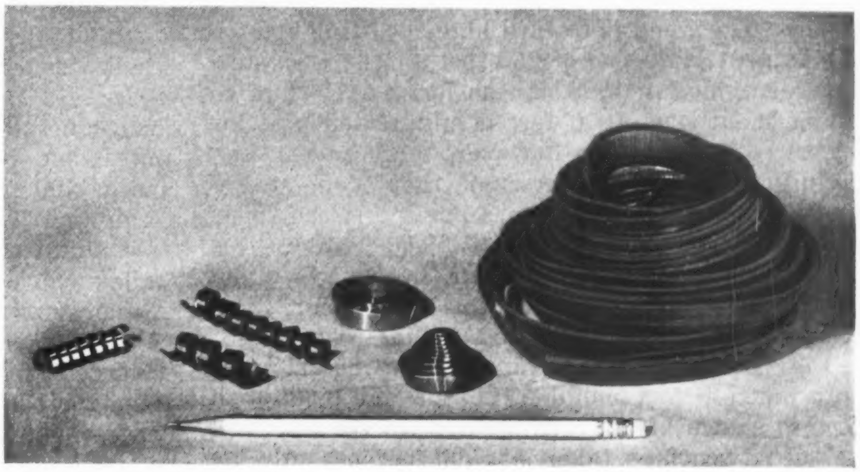


Fig. 3. A Comparison of Chips Taken by Cemented-carbide Tools at Different Speeds and Varying Power Requirements

What Cutting Speeds are Now Feasible with Cemented-Carbide Tools?

Answers to the questionnaire indicate that, on the average, cemented-carbide tools are not being used in this country at anywhere nearly their maximum capacity. Good average speeds which have proved commercially successful in everyday practice with Widia cemented carbide in Europe under good conditions are as follows:

Ordinary Gray Cast Iron—Roughing, 250 to 300 feet per minute; finishing, 260 to 400 feet per minute.

Bronze—Roughing, 1000 feet per minute; finishing, 1000 to 1650 feet per minute.

Soft Steel—Roughing, 260 to 725 feet per minute; finishing, 325 to 1000 feet per minute.

Medium Hard Steel—Roughing, 165 to 230 feet per minute; finishing, 200 to 300 feet per minute. The variation in speed depends upon the hardness of the steel, the size of chip, machine used, etc.

On the softer steels, these cutting speeds can be increased from 30 to 50 per cent by the use of one of the most modern grades of cemented carbide, provided the machine tool equipment has the necessary rigidity and speed. Even where the highest speeds are not possible, considerable savings can be effected through the greatly increased life between grinds of cemented-carbide tools.

Suitability of Present Machine Tool Equipment for Cemented-Carbide Tools

Most modern lathes are supposed to be capable of taking full advantage of any cutting tools now on the market. The writer believes, however, that still further developments in lathe construction are ahead. The trend is toward higher cutting speeds. When a cutting speed of 250 feet a minute on steel was mentioned in 1928, it was just as startling as if one mentioned 1000 feet a minute today. For such a cutting speed, however, more power and rigidity are required. Assume that a cut at 100 feet a minute requires 5 horsepower. If the speed is increased ten times, to 1000 feet a minute, this would require 50 horsepower for the same feed and depth of cut; this speed on soft steel is practical today with the best cemented-carbide tools.

Fig. 3 illustrates the point. For comparison, a chip taken at 5/8 inch depth of cut and 0.060 inch feed is shown at the right. Next, to the left, will be seen two chips taken at 650 feet per minute, 0.022 inch feed, 1/4 inch depth of cut. Fully 20 horsepower was required to pull this comparatively light cut. The next two chips were taken at 820 feet per minute, 0.027 inch feed, 1/4 inch depth of cut, over 40 horsepower being required. The last chip at the left was cut at 1450 feet per minute, 0.019 inch feed, and 0.060 inch depth of cut. It required fully 20 horsepower to remove this very light chip at this high speed. There are practically no machines available in this country today that have the power necessary to take a heavy cut with this tool at the speeds it will stand.

Some features in machine tool design that would make possible more efficient use of cemented-carbide tools, especially in machining steel, are: Increased power and rigidity; built-in motors to show the power being consumed; tachometers to show the number of spindle revolutions and speed in feet per minute for various diameters; automatic throw-out of the feed if the motor is overloaded; automatic regulation of the feed, so that the machine may operate at maximum capacity, regardless of the speed or depth of cut; separate motor drive for the feed mechanism; toolposts that can be adjusted for height of the cutting edge without the use of shims and without changing the cutting angle; and the elimination of gear chatter through some form of gearless drive.

This does not mean that much of the equipment in the shops today cannot be used advantageously in conjunction with cemented-carbide tools, nor does it mean that many of the modern machines now being built are not suitable; but it does indicate a need for modernization in many shops, as well as a need for still further power and rigidity and other improvements in machine tools, especially for machining steel, which requires from two to four times the power necessary to remove a corresponding amount of cast iron.

In conclusion, it might be well to say that apparently many shops are still obtaining the necessary information about cemented-carbide tools through bitter experience, instead of starting out by having one man whose business it is to know thoroughly the possibilities of the tools and how to handle and grind them properly. Many shops do not fully appreciate what these new tools could do for them—they are not "cemented-carbide minded."

A suitable plan for obtaining the most efficient results from all cutting tools in a plant should include: (1) One man should be appointed to take charge of all cemented-carbide tools in the shop and should be properly trained for the job. (2) Speeds and feeds should be set so as to obtain the maximum possible performance from the tools. (3) Suitable grinding equipment should be installed which will produce a good cutting edge, held to the correct angles, in the shortest possible time. (4) Certain men should be designated to grind all cemented-carbide tools. The operators should not grind their own tools. With such a plan, the maximum savings possible with any cutting tools can be obtained.

* * *

New Spot-Welder for Experimental and Development Work

Tooling up for large-scale production welding is no job for guesswork. There are often many questions to be answered and problems to be solved before the first weld is made in the shop. The Thomson-Gibb Electric Welding Co., Lynn, Mass., has developed an air-operated spot-welder which makes it possible to answer many of these questions quickly and accurately. The machine has been designed mainly for experimental and development purposes, but can also be used for regular production welding of mild steel, stainless steel, and alloys like aluminum, Monel metal, and other non-ferrous materials.

The machine has a remarkably wide range; the stroke, for example, can be adjusted to any point from 0 to 5 inches; the pressure may be anywhere from 200 to 5000 pounds; and the heat can be regulated through a correspondingly wide range. The machine can also be used for projection welding by removing the regular welding points and substituting adapters for projection welding electrodes.

Machine Tool Builders' Association Elects New President

NORMAN D. MACLEOD, president and general manager of the Abrasive Machine Tool Co., East Providence, R. I., was elected president of the National Machine Tool Builders' Association at its recent annual meeting in Hot Springs, Va. Mr. MacLeod was born in East Providence, R. I., in 1891, and is a graduate of the Massachusetts Institute of Technology. After his graduation, he was connected with the Brown & Sharpe Mfg. Co., Providence, R. I., for two years, and for the last seventeen years has been associated with the Abrasive Machine Tool Co. in various capacities. This company was started in 1916 by his father, Frank N. MacLeod; since his father's death in 1933, he has been the head of the business. Associated with him in the company are his two brothers, C. Gordon and Kenneth B. MacLeod.

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Norman D. MacLeod, Newly Elected President of the National Machine Tool Builders' Association

Mr. MacLeod comes from a family, many members of which were prominently identified with the machine industry. His father, grandfather, and great uncle were all associated with the George H. Corliss Engine Works, his father later for many years being connected with the Brown & Sharpe Mfg. Co.

Mr. MacLeod entered the Rhode Island National Guard in 1915. He served on the Texas border in 1916 and in France during the World War with the 26th U. S. Division. He is now lieutenant-colonel in the 302nd Field Artillery Reserve. He was decorated with the United States Distinguished Service Cross and with the French Croix de Guerre.

Mr. MacLeod has always taken an active part in engineering organization work. He is a member and past-president of the Technology Club of Rhode Island, a member and past-president of the Providence Engineering Society, a member of the American Society of Mechanical Engineers, and vice-president of the Associated Industries of Rhode Island.

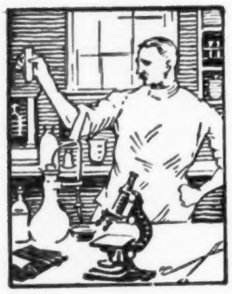
Machinery Institute and Automobile Association Oppose Revival of NRA

EXPRESSING as its judgment that any attempt to revive the NRA will retard industrial recovery, the Machinery and Allied Products Institute, 221 N. LaSalle St., Chicago, Ill., a federation of trade associations representing about 1000 manufacturers, has declared itself as opposed to the holding of round-table conferences on industrial legislation, proposed by Major George L. Berry, NRA coordinator.

On the same subject, the Automobile Manufacturers Association, in a letter to Major Berry, says: "This industry does not believe that a substitute for NRA will help the industry or its employes, but on the contrary that it will do harm. Progress of the industry in recovery has been greater since the Code terminated. This industry always has maintained labor standards far above the requirements that could be imposed by any reasonable law and does not intend to change that policy. We have taken important practical steps that already have done much to regularize employment and increase annual earnings of employes. . . . Although this industry has always been highly competitive, it is not interested now, and never has been interested, in anything savoring of price fixing or of restricting production."

Since industrial recovery is now progressing at a satisfactory rate, it would be highly objectionable for the Government at this time to advocate measures that might again create uncertainty.

MATERIALS OF INDUSTRY



THE PROPERTIES AND NEW APPLICATIONS OF MATERIALS USED IN THE MECHANICAL INDUSTRIES

The Hardness of Chromium Plate Its Chief Value in Industry

In a publication recently issued by the Chromium Corporation of America, New York City, attention is called to the fact that the chief industrial value of chromium plate arises from its extreme hardness. No other metal in regular commercial use, it is stated, is so resistant to wear and abrasion. Its high melting point also permits it to withstand high temperatures.

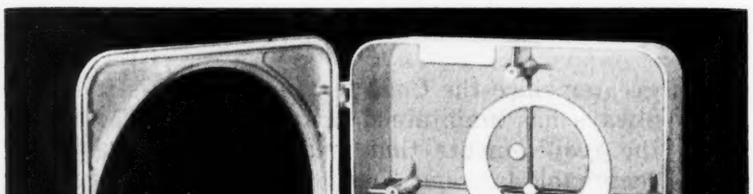
The natural corollary of hardness is resistance to abrasion, an important property of chromium plating. The best measure of this resistance is a record of actual operating results of chromium-plated pieces, as compared with unplated parts. In practically every application on pieces varying in weight from a few ounces to ten tons, chromium plate has more than doubled the life of the piece. In exceptional cases, chromium-plated parts have actually outlasted the same parts unplated fifty times.

Although chromium is the hardest of commercial metals, it has, nevertheless, been established in a series of abrasion tests, as well as in hardness tests, that there is a considerable variation, the hardest and best chromium plate being almost ten times more resistant to abrasion than the least satisfactory plate. Unsatisfactory results are usually due directly either to lack of technical knowledge or inadequate plating equipment, or both. Chromium electroplating demands considerable knowledge and practical experience, as well as extensive equipment.

For industrial purposes, the wear-resisting qualities of chromium-plated parts are of particular value. As specific instances may be mentioned the following industrial applications of chromium plating, where greatly extended life has resulted: Steel embossing rolls, six times longer life; copper printing rolls, six times; knives and slitters, five times; steel evaporator tubing, three and one-half times; high-speed steel knives, three times; casehardened steel tensions, over three times; steel dies, thirty times.

A Free-Machining Stainless Steel Developed by U. S. Steel

A stainless steel possessing free-machining qualities that enable it to be handled in much the same manner as regular carbon steels is being placed on the market by various subsidiaries of the United States Steel Corporation. This alloy has been des-



Aluminum die-castings are increasing in size. This meter case and cover, made by the Superior Die Casting Co., Cleveland, Ohio, is 16 inches high, 4 inches deep, and 12 1/2 inches wide. The weight of the case and cover is approximately 8 pounds. This is an excellent example of how the larger types of die-castings offer definite economies in production.

ignated 18-8 FM stainless steel. It can be turned, drilled, tapped, etc., satisfactorily. The steel is supplied in round, square, and hexagonal bars, and in flat stock. It is obtainable annealed and pickled, cold-drawn, centerless-ground, and polished.

For machining 18-8 FM stainless steel at high speeds, the tools should be ground with a steep top rake. It is also advisable to stone the top surface of the tool smooth enough to avoid any tendency for chips to stick. Drilling operations are facilitated by using drills with a short twist. Cutting speeds should be reduced slightly, and a heavier feed used than in machining ordinary steels.

It is particularly important that the tool cut continuously and not be allowed to glaze the surface of the work, as this would cause work-hardening and render further machining difficult.

Bakelite Resins Find New Applications

New resin-rubber combinations intended for use in the manufacture of brake linings, clutch facings, and similar products have recently been placed on the market by the Bakelite Corporation, Bound Brook, N. J. Two parts of rubber and one part of Bakelite resin are used in these products to bond an asbestos-filled material. Unusually high heat resistance is one of the advantages of this new material, the thermo-plasticity at temperatures such as 400 degrees F. having been greatly reduced. There is also an improvement in wear resistance at high temperatures.

The same company is also introducing a line of water dilutable resins for use in the manufacture of laminated sheet stock and rolled and molded tubing. Water absorption is reduced in the laminated materials made with these resins, thus prolonging the life of the materials and strengthening their electrical properties. This development has made possible the manufacture of "refinishing" laminated material for table tops, baseboard trim, wall paneling, etc.

Bakelite-Rogers board is a material consisting of pulp and fibrous products treated with Bakelite resinoid, now manufactured by Bakelite-Rogers Co., Inc., an affiliate of the Bakelite Corporation. Articles such as refrigerator breaker strips, saw handles, knobs, molded trays, baseboards, and textile bobbins are products that have been fabricated from the new material. It approaches Bakelite laminated in mechanical strength.

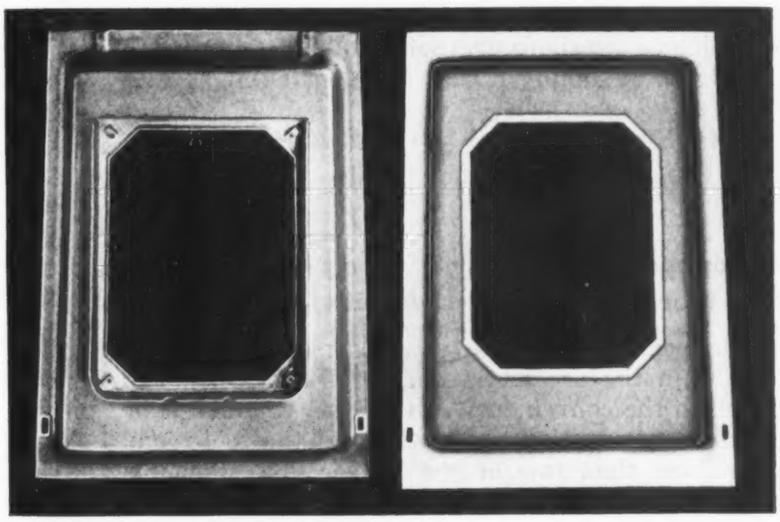
Synthetic Rubber Replaces Metal Springs in Water Pumps

A sleeve made of DuPrene, a synthetic rubber manufactured by E. I. du Pont de Nemours & Co., Wilmington, Del., was recently adopted by an automobile manufacturer to replace a metal spring in a packingless water pump. The use of synthetic rubber has proved successful in this application because it is elastic and is impervious to alcohol, anti-freeze solutions, and radiator cleaning compounds.

It is mentioned by the manufacturer that many DuPrene compounds are suitable for service conditions where natural rubber products fail to give satisfactory service, because the synthetic rubber compounds withstand oil and chemicals, and in addition, have less tendency to crack when repeatedly stretched and flexed at elevated temperatures.

One Hundred Tons of Stainless Steel Used on the "Normandie"

Stainless steel letters 3 feet high on the bow of the *Normandie* proclaim the name of this luxurious greyhound of the French Lines. But that is not all the stainless steel on board; this material is used for moldings, baseboards, bath fixtures, beds, furniture, railings, and many other parts. All together, more than 100 tons of stainless steel were used in fitting out this vessel.



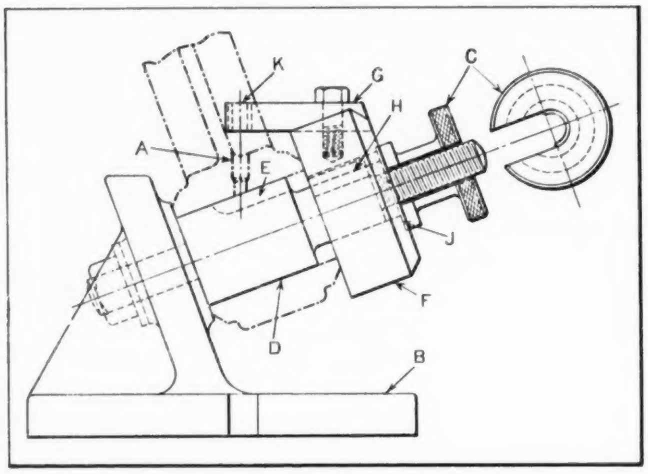
The large zinc-base alloy die-casting shown is approximately 22 inches high by 15 inches wide, weighing 6 pounds. This frame for a gasoline pump dial was economically produced, with all the required slots and holes cast, by the Superior Die Casting Co., Cleveland, Ohio. This type of casting lends itself to a wide variety of different types of finishes.

Ideas for the Shop and Drafting-Room

Time- and Labor-Saving Devices and Methods that Have been Found Useful by Men Engaged in Machine Design and Shop Work

Jig with Quick-Acting Clamping Nut of Slotted Type

The outstanding feature of the jig shown in the accompanying illustration is the quick-acting slotted knob or nut *C*. The work, shown in dot-and-dash lines, is put on stud *D* for drilling the oil-hole *A*. A groove *E* cut in the stud provides for drill and chip clearance. After the jig is loaded, the collar *F*, which is grooved to fit the bushing plate *G*, is put in place, the key *H* keeping it in alignment.



Jig with Slotted Clamping Nut C that can be Placed on Stud and Tightened with Fraction of a Turn

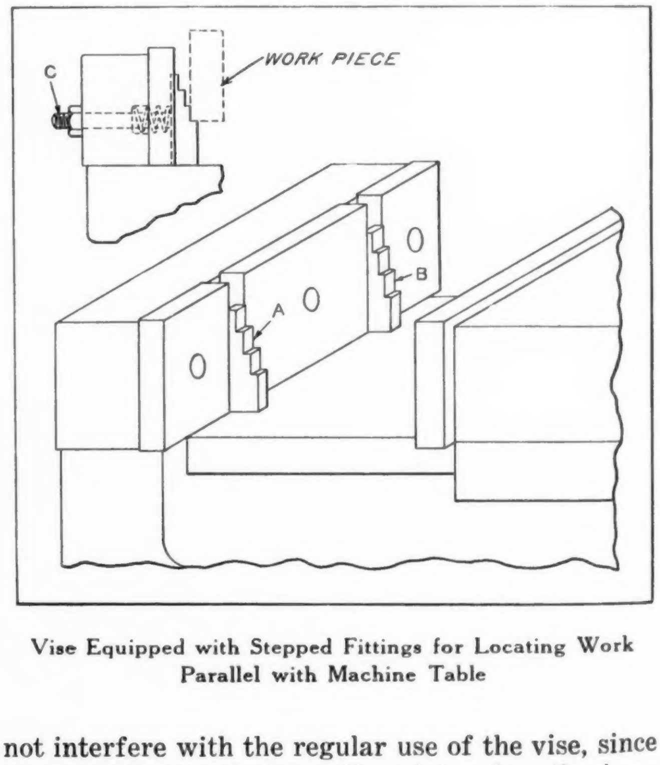
The collar is counterbored at *J* about 1/32 inch deep to receive the flanged end of the slotted knob *C*. This counterbore prevents the knob from working loose or falling off during the drilling operation.

New Brunswick, N. J. CHARLES C. TOMNEY

Stepped Vise Fittings Serve as Substitute for Parallels of Different Heights

Stepped vise fittings, such as those shown at *A* and *B* in the accompanying illustration, will add much to the convenience of the vise, whether it be used for production purposes or in the tool-room. The fixed steel jaw of the shaper vise shown is made in three parts, in order to form slots or recesses for the stepped fittings. The view in the upper left-hand corner of the illustration shows the construction of the fittings. A threaded stud *C* is attached to each fitting. The main portion of the vise has holes drilled through it in which the studs *C* slide freely. These holes are counterbored to receive coiled springs which act as cushions for the stepped parts. The nut that fits over the threaded section of the stud acts as a stop. Thus, when a piece to be machined is located on the lower step, as shown by the dotted lines, the step jaws will be forced inward until the work piece comes in contact with the stationary jaw of the vise.

As the stepped surfaces are identical in height, it is obvious that the work piece will be located parallel with the base of the vise. If the stepped fittings are attached to the vise accurately, their sides may be used for squaring up short pieces that must be machined on their ends. The fittings do not interfere with the regular use of the vise, since they recede into their locating slots when the jaws of the vise are closed or clamped on a piece of work. When the jaws are opened, the springs return the fittings to the positions shown.



Vise Equipped with Stepped Fittings for Locating Work Parallel with Machine Table

Meriden, Conn. PETER BUDWITZ

NEW TRADE  LITERATURE

Recent Publications on Machine Shop Equipment, Unit Parts, and Materials. Copies can be Obtained by Writing Directly to the Manufacturer.

Welding and Cutting Equipment

LINDE AIR PRODUCTS CO., UNIT OF UNION CARBIDE & CARBON CORPORATION, 30 E. 42nd St., New York City. Pamphlet entitled "The Repair of Damaged Cast-iron Machinery," describing the use of oxy-acetylene welding in work of this class. The booklet discusses the applications for which the processes of bronze welding and fusion welding are best suited. It also tells how the composition, physical properties, and intended use of the casting influence heat-control methods and the choice of welding procedure.

Ball Bearings

FAFNIR BEARING CO., New Britain, Conn. Bulletin entitled "Super Precision Ball Bearings for Spindles," describing the methods of application of the preloaded type of bearing in machine spindles. Sectional drawings of typical machine spindles show the bearing arrangements required to meet specific conditions of accuracy and load on high-speed grinders, engine lathes, and other precision machine tools. Suggestions for precision fitting and mounting are included.

Anti-Friction Bearings

NORMA-HOFFMANN BEARINGS CORPORATION, Stamford, Conn. Bulletin illustrating machine tool applications of Norma-Hoffmann precision bearings. The bulletin shows, in blueprint reproductions of engineering drawings, a wide diversity of applications of precision ball, roller, and thrust bearings in spindles of automatic machines, drilling machines, milling machines, drilling and boring machines, grinders, lathes, buffing machines, and high-speed routers.

Texrope Drives

ALLIS-CHALMERS MFG. CO., Milwaukee, Wis. Bulletin 1259, entitled "A Fine Tool Deserves the Perfect Drive," dealing with Texrope drives as applied to machine tools. Sixty typical applications of the V-belt drive to modern machine tools of all kinds are illustrated. The advantages of this type of drive are pointed out, and sizes are given. The catalogue also describes the features of the new "Vari-Pitch" and "Duro-Brace" sheaves for Texrope drives.

Ball Bearings

S K F INDUSTRIES, INC., Philadelphia, Pa. Loose-leaf bulletin descriptive of a new grinder spindle design mounted in ball bearings, brought out by this company. The booklet is illustrated by line drawings that show clearly the construction details of this spindle. Various applications of this construction in different types of machines adapted for specific classes of work are also illustrated and described.

Zinc Die-Castings

NEW JERSEY ZINC CO., 160 Front St., New York City. Bulletin entitled "Zamak Alloys for Zinc Alloy Die-Castings," describing the development of these alloys and giving technical information on the composition, physical and mechanical properties, and characteristics. Information is also given on the finishing of zinc alloy die-castings and the machining and assembly of these castings.

Small Tools

BROWN & SHARPE MFG. CO., Providence, R. I. Catalogue 32, containing 448 pages, 4 1/2 by 6 1/2 inches, listing the complete B & S line of small precision measuring tools, milling cutters, hobs, arbors, and miscellaneous shop equipment. Many new products are shown for the first time in this catalogue. The book is completely indexed to facilitate reference.

Die-Heads

LANDIS MACHINE CO., INC., Waynesboro, Pa. Circular illustrating three different types of threading die-heads, namely the Lanco (Type V), a revolving head for use on hand and automatic threading machines; the Landex (Type L), a revolving head for use on automatic screw machines; and the Landmatic (Type H), a stationary pull-off type head for use on turret lathes or hand screw machines.

Welding Equipment

LINCOLN ELECTRIC CO., Cleveland, Ohio. Catalogue covering the line of arc-welding electrodes and accessories made by this company. The characteristics of the different electrodes, the class of work for which each is especially adapted, and the welding procedure to be followed in each case are described.

Lathes

SOUTH BEND LATHE WORKS, 768 E. Madison St., South Bend, Ind. Catalogue 15-W, describing the new 9-inch "Work Shop" precision lathe made by this company. The booklet contains a large number of illustrations and descriptions covering the eight different models of this lathe.

Notching Presses

V & O PRESS CO., Hudson, N. Y. Bulletin containing four full-page illustrations of four different types of high-speed notching presses for rotors, stators, and segments. Brief descriptions giving the salient features, such as capacity, speed, etc., are included.

Couplings

JOHN WALDRON CORPORATION, New Brunswick, N. J. Bulletin 51, briefly describing the Waldron cross-type couplings, which are designed to meet the demand for an inexpensive flexible coupling for light-duty motor drives where misalignment of connected shafts is unavoidable.

Rotary Files

ROTARY FILE CO., Stratford, Conn. Catalogue showing many shapes of

hand-cut rotary files made by this company. Several special shapes are also shown, as well as examples of a recently added line of mill-cut files for removing stock from deep, narrow recesses.

Roller-Bearing Units

LINK-BELT CO., 307 N. Michigan Ave., Chicago, Ill. Book 1494, describing the Link-Belt new Series 400 line of self-aligning anti-friction bearing units equipped with Shafer double-row roller bearings. Complete specifications, including prices, are given.

Arc Welders

HARNISCHFEGER CORPORATION, Milwaukee, Wis. Bulletin HW-4, entitled "Weldit Well," covering the complete line of P&H-Hansen arc welders, ranging from 50- to 800-ampere units, as well as welding fixtures and accessories.

Self-Opening Stud Setters

MODERN TOOL WORKS, DIVISION OF CONSOLIDATED MACHINE TOOL CORPORATION, Rochester, N. Y. Bulletin M-185-A, describing in detail the construction, operation, and time-saving features of the Modern self-opening stud setters.

Rotary Pumps

GEO. D. ROPER CORPORATION, Rockford, Ill. Bulletin R5, containing illustrations and complete tables of specifications covering the Roper line of direct-drive rotary pumps for hydraulic power transmission and general purposes.

Lo-Swing Lathes

SENECA FALLS MACHINE CO., Seneca Falls, N. Y. Bulletin 104, illustrating and describing the Lo-Swing "Imp," a compact automatic machine for turning small parts at high speed and low costs. Complete specifications are given.

Electric Equipment

GENERAL ELECTRIC CO., Schenectady, N. Y. Bulletins GEA-2226 and 2227, describing the construction and advantages of General Electric CR-2800 direct-current contactors for heavy-duty service and continuous operation.

Metal Sawing Machines

RASMUSSEN MACHINE CO., INC., 1016 Eighth St., Racine, Wis. Circular describing the details of construction of the Rasmussen metal sawing machine, which is built in two styles for automatic or manual operation.

Gear Generators

FARREL-BIRMINGHAM CO., INC., Ansonia, Conn. Catalogue on Farrel-Sykes gear generators, listing the various sizes and describing the design and construction of these machines, as well as their set-up and operation.

Mica Under-Cutters

IDEAL COMMUTATOR DRESSER CO., 1011 Park Ave., Sycamore, Ill. Circular describing the improved Ideal electrically driven under-cutter with micrometer gage, used for servicing and under-cutting commutator mica.

Diamond Wheels

CARBORUNDUM CO., Niagara Falls, N. Y. Leaflet describing how diamond wheels are used in the preparation of petrographic thin sections for the microscopic examination of natural and artificial minerals.

Cold-Drawn Steel

UNION DRAWN STEEL CO., Massillon, Ohio. Leaflet entitled "Union Cold Drawn Steel and the Machine Tool," pointing out the part that cold-drawn steel plays in the efficient production of steel parts.

Pumps

WORTHINGTON PUMP & MACHINERY CORPORATION, Harrison, N. J. Catalogue W-475-B8, containing data on Worthington double helical rotary pumps. Bulletin W-450-B24, covering deep-well turbine pumps.

Power Transmission Equipment

MORSE CHAIN CO., DIVISION OF BORG-WARNER CORPORATION, Ithaca, N. Y. Circular illustrating a variety of applications of the Morse 3/16-inch pitch chain. Chain and sprocket data, including prices, are given.

Hard-Facing Welding Rods

AMERICAN MANGANESE STEEL CO., DIVISION OF AMERICAN BRAKE SHOE & FOUNDRY CO., Chicago Heights, Ill. Circular describing the characteristics and applications of Amsco hard-surfacing welding rods.

Wrenches

J. H. WILLIAMS & CO., 75 Spring St., New York City. Leaflet listing the sizes and prices of Williams' "Non-Sparking" safety wrenches, which are drop-forged from beryllium-copper.

Bearing Pullers

CURTISS & SMITH MFG. CORPORATION, Pottstown, Pa. Circular illustrating a bearing puller designed to remove bearings without a single blow and without danger to the mechanic or damage to the bearing.

Tube Fabricating Equipment

PARKER APPLIANCE CO., Cleveland, Ohio. Bulletin 40, illustrating and describing various types of tube fabricating tools, including benders, flaring tools, etc. Instructions for using the different tools are included.

Welding Equipment

HOBART BROS. CO., Troy, Ohio. Circular illustrating and describing the special features and advantages of the new Hobart 75-ampere electric arc welder, which is especially adapted for welding light-gage metal.

Nichrome Alloys

DRIVER-HARRIS CO., Harrison, N. J. Pamphlet giving the analyses of different Nichrome heat- and corrosion-resisting alloys, and applications for which each is especially suited.

Malleable Castings

LAKE CITY MALLEABLE CO., 5406 Lakeside Ave., Cleveland, Ohio. Leaflet listing the information essential for buyers to furnish to the foundry in ordering malleable castings.

Speed Reducers

CHARLES BOND CO., 617 Arch St., Philadelphia, Pa. Booklet GA-37, listing Bond stock speed reducers, which are made in twenty-one different sizes, with many ratios in each size.

Pumps

WEINMAN PUMP MFG. CO., 290 Spruce St., Columbus, Ohio. Bulletin 726, covering the line of "Unipumps" designed for general service.

Plating Equipment

UDYLITE CO., 1651 E. Grand Blvd., Detroit, Mich. Folder giving information about cadmium, copper, and zinc ball anodes.

Screw Machine Reamers

PRATT & WHITNEY CO., Hartford, Conn. Circular 416, descriptive of stub screw machine reamers.

Shop Equipment News

Machine Tools, Unit Mechanisms, Machine Parts, and Material-Handling Appliances Recently Placed on the Market

Pratt & Whitney Co. Introduces New Model C Lathe

The Pratt & Whitney Co., Hartford, Conn., introduced to the trade at the Cleveland Machine Tool Show a Model C lathe which succeeds the Model B lathe built by the concern over a period of years. Two sizes of the new machine were exhibited having nominal swings of 14 and 16 inches. Each of these sizes is available in two lengths which provide center-to-center distances of 30 and 54 inches.

The Model C lathe is driven by a constant-speed motor, mounted on a hinged platform in the cabinet leg under the headstock. A multiple V-belt drive carries the power to the main driving pulley at the rear of the headstock, the pulleys and belts being completely enclosed by a sheet-metal guard. All electrical controls are contained in the cabinet leg under the tailstock. A push-button station mounted on the quick-change gear-box is used for starting and stopping the motor.

An unusual feature of the lathe is that the bed and headstock have been built out at the rear, as shown in Fig. 2, to provide a "column headstock" which insures solid support for the driving pulley, takes the pull of the driving belt, and does away with excessive overhang. In addition, a larger surface area is obtained for the oil reservoir, so that the oil used for lubricating the spindle bearings and gears remains cool under continuous operation. A Cuno filter at the rear of the bed cleans the oil, which is used over and over again.

A multiple-disk clutch transmits power from the main driving pulley to the headstock gearing, this clutch being controlled from the front of the headstock and from the apron. Eighteen spindle speeds ranging from 14 to 1000 revolutions per minute are obtained through spur gears, which are hardened and ground to insure quiet and accurate operation.

The spindle of this lathe is unusually heavy and is supported at three points. The front and middle supports are preloaded precision ball bearings, while the rear bearing is of the roller type. The spindle nose is the new Type D-1, and is flanged. A cam-lock device, instead of the usual screw threads, permits chucks to be mounted easily and accurately. The quick-change gear-box provides sixty feeds ranging from 0.003 to 0.188 inch, and sixty thread changes from 1 to 60 per inch, inclusive.

The carriage and apron are designed to provide full accessibility without removing the apron from the machine. A new synchronizing high-speed clutch mechanism has been incorporated in the headstock for reversing the lead-screw and feed-rod drive so that it is possible to reverse the carriage at high speeds without stopping the lathe. Quick-acting levers insure positive clutch engagement for both longitudinal and transverse feeds. The carriage is mounted on one vee and one flat way on the bed and is unusually deep and wide.

The quick-withdrawing mechanism for thread cutting operations, which was provided on Model B lathes has been incorporated in the Model C. Also,

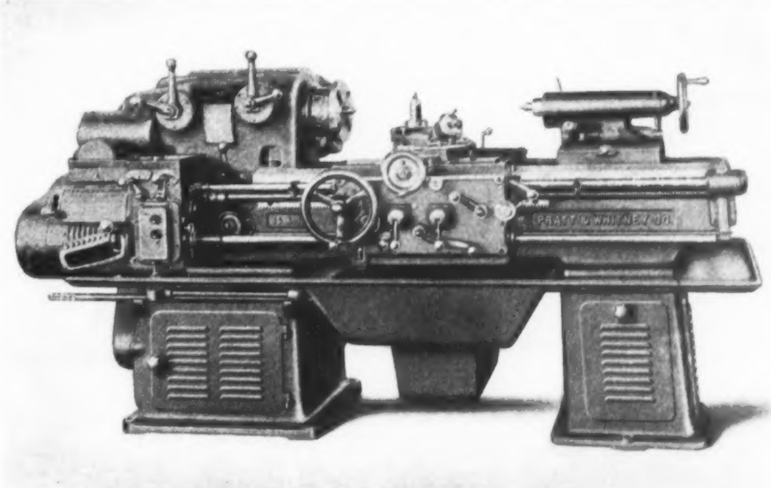


Fig. 1. Model C Lathe Recently Brought out by the Pratt & Whitney Co.

the compound rest is of similar design, with its handwheel positioned at an angle to provide knuckle clearance. The tool-slide is constructed from a steel casting to prevent the T-slot from breaking out under heavy pressure. The binder that releases the carriage cross-feed for operation of the taper attachment is moved by a lever, thus adding to the convenience of the machine. Adjustable dogs are furnished for controlling the carriage movement in either direction. All micrometer dials are graduated to read direct in thousandths of an inch.

The tailstock has the same clamping features as on the Model B lathe. The spindle is graduated for boring accurately to required depths.

Two central reservoirs supply lubricant to the various moving parts of the lathe, there being only a few points where hand-oiling is necessary. Tapers up to 20 degrees included angle (4 inches per foot) and up to 18 inches in length can be turned by means of the attachment bolted to the rear of the bed. One end of the attachment is graduated in degrees, and the other in inches per foot. The two lengths of the 14-inch Model C lathe weigh 3700 and 4000 pounds, while the 16-inch size weighs 4000 and 4300 pounds.

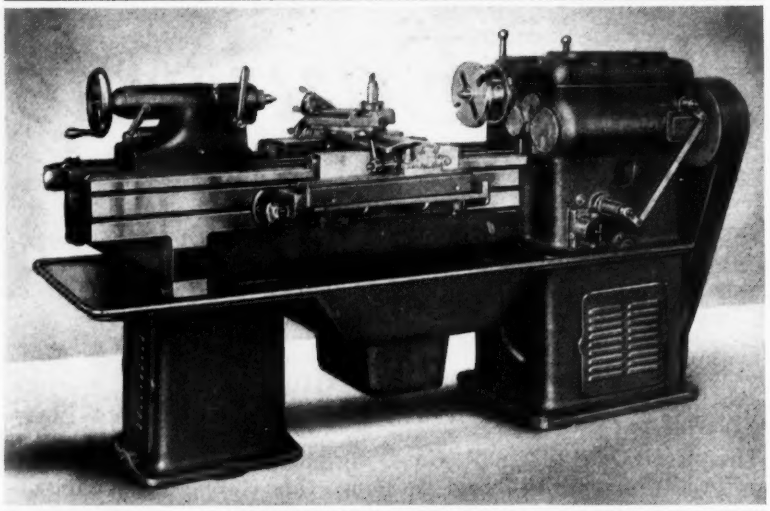


Fig. 2. Rear View of Model C Lathe, Showing how the Headstock and Bed are Built to Give a Column Type Construction

Quickwork Trimming and Beading Machine for Stampings

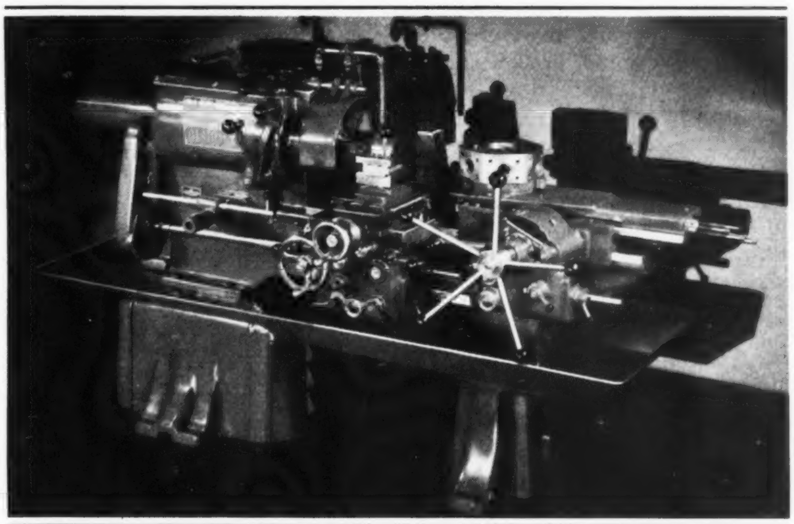
A further development has been made in the line of stamping trimming machines built by the Quickwork Co., St. Marys, Ohio, whereby the stampings are beaded and the flash is trimmed in one operation and at one pass of the stamping. The machine will handle stampings of any shape which are to be trimmed, beaded, and flanged in one plane, including rectangular stampings with round corners or round stampings. Pieces of both large and small dimensions can be handled.

The entire table of the machine can be quickly raised or lowered by operating a handwheel. This new feature reduces the time required for changing from one stamping to another when small lots are being handled. The main spindles of the machine are mounted on roller and ball bearings, and the shafts are hardened and ground.

Quickwork Machine for Beading and Trimming Flash from Stampings in One Operation

Quick-Detachable Welding Cable Connector

A quick-detachable connector designed for use in connecting welding or electrode cable has been brought out by the Lincoln Electric Co., Cleveland, Ohio. An important feature of this connector is that it is so locked in making a connection that it cannot work loose or be accidentally pulled apart. The making of a connection is so simple that it can be done in the dark. Protection against grounding is provided by fiber insulating sleeves.



Gisholt Ram Type Turret Lathe which is Designed for Fast Manipulation

Gisholt Ram Type Turret Lathes

Automatic labor-saving devices that facilitate fast manipulation are featured as standard equipment on three ram type turret lathes recently developed by the Gisholt Machine Co., Madison, Wis. These machines are intended for both high-production work and small-lot jobbing. They are identical in design and construction, differing only in size and capacity. The bar capacity ranges from 1 1/2 to 2 1/2 inches, and the chucking capacity from 8 to 15 inches. Tapered roller bearings and hardened alloy steel gears are supplied throughout the machines, while the ways of the turret slide, saddle, and bed are pieces of hardened steel, which are ground in place.

The hexagon turret and its stop roll are automatically indexed with the back movement of the ram slide. As the ram slide goes forward to the work, the hexagon turret is automatically located and clamped in place. The operator need not take his hands from the pilot wheel to accomplish this cycle. The quick-indexing square turret on the cross-slide is arranged to hold four tools. A single-lever movement accomplishes indexing, locating and clamping. A forward and backward movement of the lever indexes the toolpost ready for the next operation.

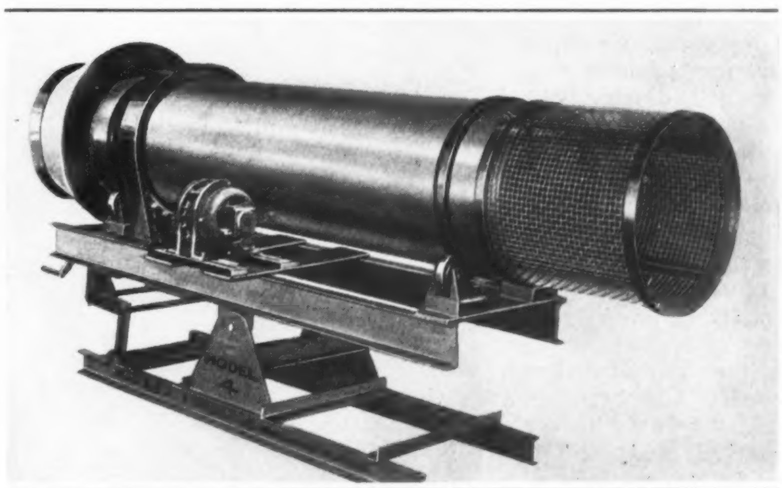
The selective-gear transmission permits changes in spindle speed without passing through intermediate speeds. Three levers control the twelve available speeds. The shift from a high to a low speed, as required in changing from drilling to reaming or from turning to threading, is made through multiple-disk clutches without stopping the spindle.

A single lever also controls shifting from forward to reverse. When this lever is placed in the neutral position, a brake is automatically applied to stop the spindle, so that time is not lost in waiting for work to coast to a stop before reversing. A safety latch in the neutral position prevents accidental starting of the machine.

The oiling of these turret lathes is accomplished by means designed to save the operator's time and to insure adequate lubrication. The headstock is automatically oiled by a splash system, the gears running in an oil bath and carrying the oil to all bearings and moving parts. The tapered roller spindle bearings receive clean filtered oil continuously from a reservoir. The aprons are automatically oiled by a forced-feed system which pumps a steady stream over the gears and bearings. Hand pumps are provided at the ends of the apron for lubricating the ways.

Barber Continuous Tumbling Machine

An improved Model 4 machine for tumbling metal stampings, forgings, and other machine products has been brought out by the Barber Tumbling Machine Works, P. O. Box 26, Oak Park, Ill. One of the improvements is a conical hopper which is welded to the cylinder. This hopper revolves with the cylinder



Barber Tumbling Machine which is Designed for Continuous Operation

and takes the place of the stationary type formerly used. The clearance space previously required between the cylinder and hopper has been eliminated by welding the hopper to the cylinder, thus preventing dust and dirt from escaping and being deposited under the machine. Another improvement is the location of the driving motor at the side of the cylinder, where it is accessible for oiling.

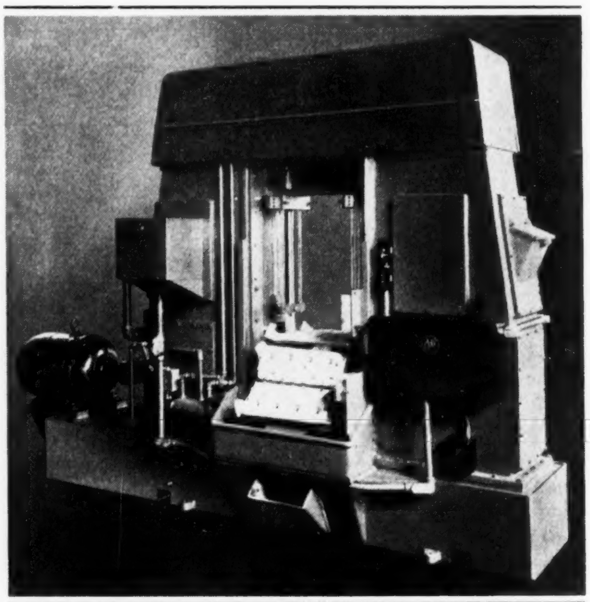
With the cylinder of this machine tilted at the proper angle for continuous operation, the material being tumbled flows through the hopper into the cylinder and onward through the screening section. The screening section automatically separates all foreign matter from the material, which is cleaned and discharged from the machine, ready for use. When articles require prolonged tumbling, the cylinder may be tilted to retard the rate of discharge or to entirely prevent the work from passing through the outlet. Thus the machine can be employed for batch tumbling operations. The material being tumbled can be inspected at any time without stopping the machine.

American Continuous Broaching Machine

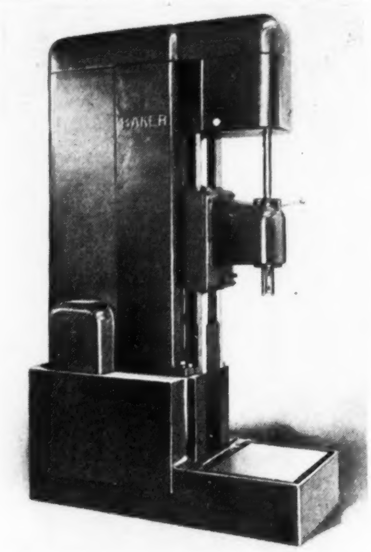
A continuous vertical broaching machine arranged for finishing elongated holes in aluminum cylinder heads used on a V-8 automobile engine has been developed by the American Broach & Machine Co., Ann Arbor, Mich. Four holes are machined at a time by push-broaching, two cylinder heads being completed every fourteen seconds.

In operation, two cylinder heads, one right- and one left-hand, are put on the loading side of the revolving table, where they are located by dowel-pins. The machine then automatically indexes, bringing the two parts into the top position ready for broaching. Hydraulically operated clamping bars now advance rapidly and clamp the work. The broaches finish the holes, a cutting section on each broach being followed by a series of burnishing teeth.

Immediately upon completing the broaching stroke, the machine reverses the stroke, drawing the broaches back through the broached holes. The burnishing portions of the broaches increase the size of the holes sufficiently to allow the cutting edges of the broaches to clear the finished holes. When each broach reaches its upper position, the clamping bar is raised automatically and the drum table indexed to receive the next two cylinder heads. The broached cylinder heads are unloaded automatically, and so the sole work of the operator consists of placing new heads in position on the revolving table. The stroke of the machine is approximately 24 inches, and the broaches are 18 inches long.



Continuous Broaching Machine Brought out by the American Broach & Machine Co.

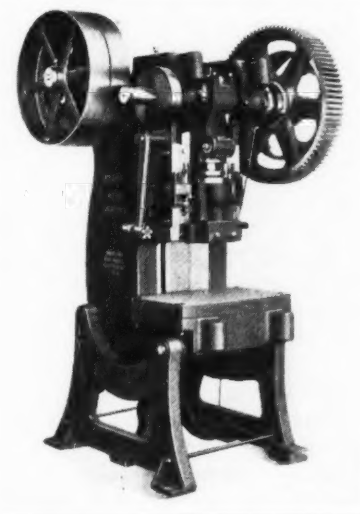


Baker Single-spindle Hydraulic-feed Drilling Machine

Baker "Clean-Line" Drilling Machines

Hydraulic machines for drilling, boring, and forming, known as "Clean-Line," from the fact that they have been designed with an exterior that is free from unnecessary details have been announced by Baker Bros., Inc., Toledo, Ohio. The working parts of these machines are fully enclosed to afford maximum protection.

The Model No. 10-HO single-spindle machine illustrated, is the smallest of three sizes in which this particular type is made. One control lever governs the cycle of operations, and it is also used as an emergency reversing lever should the occasion arise. The feeding pressure is supplied by an Oilgear Type F pump, which, together with its driving motor, is built into the base of the machine. When a lubricant outfit is required, it is driven from the Oilgear driving motor, and this equipment is also incorporated in the base of the machine.



Rockford Inclinable Press with New Locking Device

Rockford Improved Inclinable Press

Several important improvements have been incorporated in a No. 5 1/2 R inclinable open-back punch press being placed on the market by the Rockford Iron Works, Rockford, Ill. One of the improved features is a new locking device consisting of a split plug and draw-bolt which lock the adjusting screw to the connecting-rod. This design replaces the old familiar saw slot which allows the connecting-rod to be squeezed on the adjusting screw. Another improvement is an alloy steel crankshaft which has both the brake collar and clutch collar forged in one piece.

This press has a capacity of 56 tons. The flywheel type weighs 7700 pounds, and the single geared type 8950 pounds.

Waldron Gear Type Flexible Couplings

For drives where a resilient type coupling is not required and where strength is the determining factor, the John Waldron Corporation, New Brunswick, N. J., has brought out a medium-duty gear type coupling for shafts of nominal sizes up to 3 1/2 inches and a torque-ring gear type coupling for shafts of larger sizes. These couplings are built of either forged or cast steel. They are claimed to be noiseless in operation at all loads and speeds. They are entirely enclosed.

Misalignment is compensated for by meshed gears with large contact areas which are continuously lubricated by oil under centrifugal pressure. The medium-duty coupling consists of two hubs, each of which is provided with a set of external gear teeth. Each half of the vertically split housing is provided with a set of internal gear teeth which mesh with the external teeth on the hubs. These two sets of teeth are located at the extreme ends of the coupling, and their action, together with that of the housing, permits the coupling to function, within limits, similarly to a universal joint.

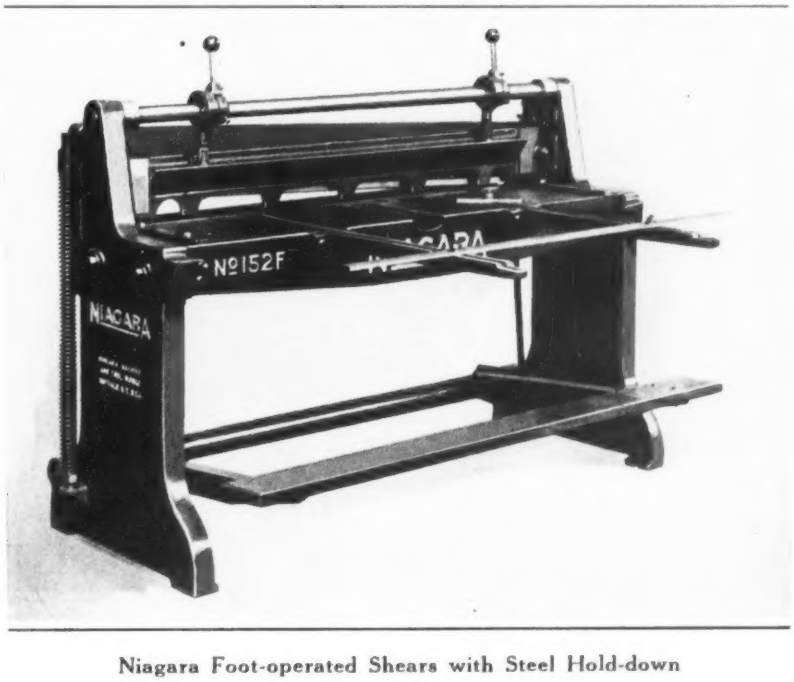
The torque-ring coupling is similar to the medium-duty design, except that in place of one set of internal and external teeth at each end of the coupling, there are two such sets. The hub and sleeve teeth do not mesh directly, but engage the internal and external teeth of a torque ring. This design provides double engagement at each end of the coupling, which greatly increases the misalignment capacity without increasing the weight or length of the coupling.

Niagara Foot-Operated Squaring Shears

A complete new line of Series F foot-operated squaring shears for cutting No. 16 gage metal has been developed by the Niagara Machine & Tool Works, 637-697 Northland Ave., Buffalo, N. Y. These shears have been designed to be operated with minimum effort. Accessibility and smooth, accurate shearing are also features.

A steel hold-down which is operated manually by self-locking eccentrics is incorporated in the design. This hold-down exerts the heavy pressure on the sheet metal required to maintain accurate shearing throughout the entire length of the cut. The hold-down, as shown in the illustration, is designed to permit a good view of the cutting edge, in order to facilitate locating the sheet for shearing to a line.

A steel cross-head provides a rigid backing for the knife. On the shears for cutting lengths of 96 and 120 inches, a patented



Niagara Foot-operated Shears with Steel Hold-down

parallel-screw back gage is furnished, which can be easily adjusted from either end of the machine. A pin is provided for each index-plate, by means of which the gage is locked when the desired setting is obtained. A graduated steel scale permits the gage to be adjusted without the use of a rule.

The Series F shears are completely equipped with shear knives and back, front, side, and bevel gages. They are available in cutting lengths of from 36 to 72 inches for No. 16 gage material. Foot-operated shears in 8-foot and 10-foot cutting lengths are also available for No. 18 gage material.

Warner & Swasey Cutting Speed Pre-Selector

A cutting speed pre-selector for machine tools has been developed by the Warner & Swasey Co., Cleveland, Ohio. This device provides a single-lever control, not only for shifting gears, but also for actuating the forward and reverse clutch. It also provides a built-in cutting speed selector and a speed sequence indicator.

The operation of a headstock by means of a single lever offers a number of advantages. Heretofore, three levers were used on a Warner & Swasey twelve-speed head for shifting the gears, and a fourth lever was required for manipulating the forward and reverse clutch. The operator had to use both hands and bend his body in order to reach the four levers. With the single-lever control provided by the cutting speed pre-selector, the operator stands erect in the working position as he changes the spindle speed.

Another important advantage of this single-lever control is that a triple gear shift can be made as easily as a single gear shift, and so it is always convenient for the operator to use the most productive speed on the particular operation being performed. He chooses the proper cutting speed and feed for the next cut to be performed by simply revolving a handwheel.

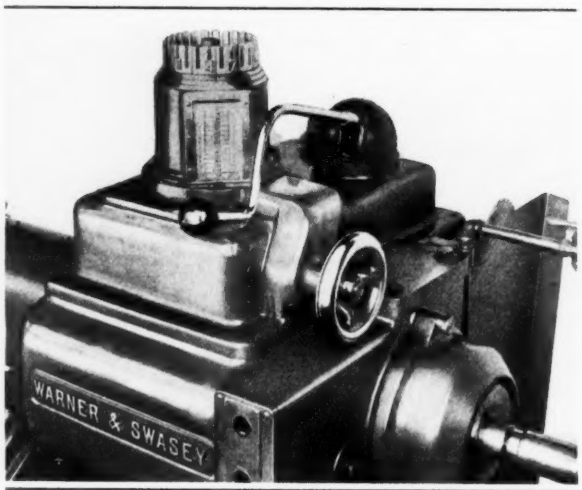
The calculator of the unit shows the full range of work diameters on the left- and right-hand sides of a window, as seen in the illustration. A drum which is rotated inside the housing indicates the speed, in feet per minute, for each work diameter in twelve vertical columns corresponding to the twelve speeds of the headstock.

In selecting a cutting speed, the operator merely revolves the drum until the desired "feet per minute" appears opposite the diameter of work to be machined. The turning of the drum sets the control for obtaining the speed automatically. Then, as soon as the cut in progress has been finished on the work, the operator, by simply moving the single lever, shifts the machine to the pre-selected speed for which the calculator has been set.

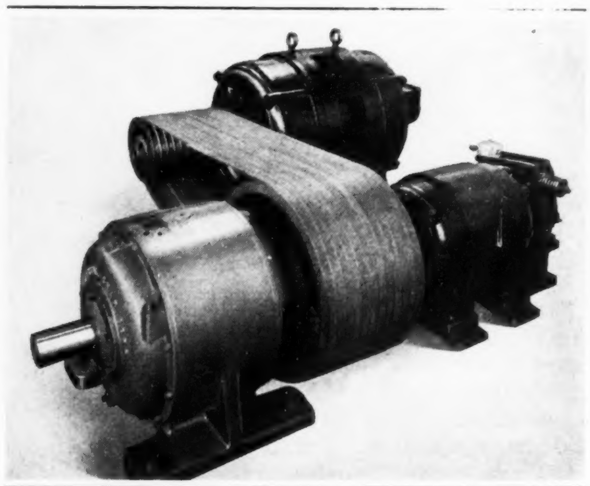
There is a speed sequence indicator in the form of a castellated drum on top of the device. Numerals are inserted in the slots of this drum to indicate the sequence of the several speeds required on a job. After a job has been set up, the operator merely revolves this drum consecutively to the positions indicated by the numerals and operates the single lever.

Four-Speed Drive Controlled by Electric Switches

Through an unusual arrangement of two electric motors, magnetic brakes, and a speed reduction unit, four speeds are instantly available without gear shifts on a driving unit developed



The Cutting Speed Pre-Selector Provides a Single-lever Control



Four-speed Driving Unit Permits Instant Selection of a Desired Speed

by the Universal Gear Corporation, 19th and Martindale Ave., Indianapolis, Ind. One of four units built for driving force-draft fans in the public utility power plant of the LaClede Gas & Electric Co., St. Louis, Mo., is shown in the accompanying illustration. This unit is equipped with a 150-horsepower motor and a 50-horsepower motor. Both motors run at a speed of 1800 revolutions per minute.

Four speeds, of 1000, 750, 500, and 250 revolutions per minute, can be obtained at will without stopping the drive and without shock to the driven apparatus by operating electric controlling switches. The design of the unit can be easily changed to give other maximum and minimum speed values and different intermediate speeds which do not have to be in equal steps. A unit of similar but somewhat simplified design can also be built for two-speed applications. By employing a four-speed reversible motor, it is possible to obtain as many as thirteen speeds. Drives of this design, utilizing fractional horsepower motors, are being used on machine tools.

South Bend 9-Inch Lathe

Ten improvements are incorporated in a 1936 model 9-inch back-geared lathe being introduced on the market by the South Bend Lathe Works, 768 E. Madison St., South Bend, Ind. These improvements include a twin gear reverse, which allows immediate changes in cutting right- and left-hand screw threads; automatic longitudinal feeds to the carriage; a ball thrust bearing for the headstock spindle; a tailstock of stronger design; an improved compound rest; a saddle of heavier construction; and simplified gearing for obtaining different threads and speeds. The lathe is a popular priced machine designed for small-piece production jobs, toolmaking, instrument making, etc. All kinds of metals, synthetic plastics and composition materials can be machined.

Six bench models and two floor models are available, and four different bed lengths of from 3 to 4 1/2 feet can be supplied. The bed is a one-piece casting made of 50 per cent steel and 50 per cent nickel iron. It has three planed and hand-scraped V-ways. Six spindle speeds of from 39 to 630 revolutions per minute are regularly available, while the thread-cutting range is from 4 to 40 per inch.

Extra power for heavy work can be obtained through a special four-step cone headstock and a V-belt drive which provides eight spindle speeds; a two-step double V-belt drive cone which provides four spindle speeds; or a single-step triple V-belt drive which provides two spindle speeds. Motors up to 3/4 horsepower can be used to their full capacity. The back-gear ratio of 5 to 1 also permits the taking of heavy cuts with the regular headstock.

Attachments intended for manufacturing operations and for general machine shop work may be fitted to all sizes of this lathe to adapt them to a wide variety of work.

Weldon End-Mill Sharpening Fixture

The end-mill sharpening fixture here illustrated is manufactured by the Weldon Tool Co., 321 Frankfort Ave., Cleveland, Ohio. While this fixture was originally designed for rapid and accurate production sharpening, it is well adapted for general re-

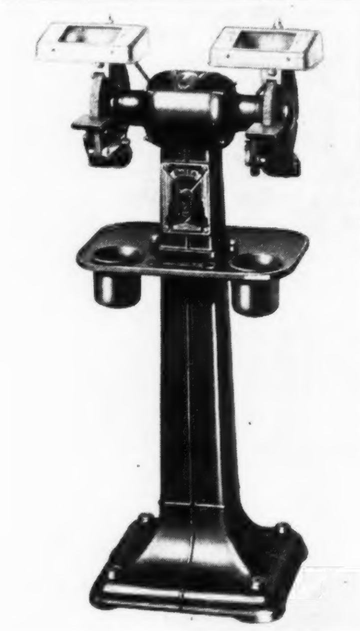
South Bend 9-inch Lathe for Manufacturing and Tool-room Use

Weldon Fixture Designed for Sharpening End-mills

conditioning requirements in the average machine shop.

The fixture is adaptable to all types of end-mills of any spiral angle and having either right-hand or left-hand spiral flutes. No centers or lead cams are necessary. The fixture has a rocking head which permits the end-mill to be moved away from the wheel when grinding without changing the machine setting. A guiding finger contacts with the inner side of the flute in such a manner that it revolves the end-mill only when the cutter is rotated against the spiral.

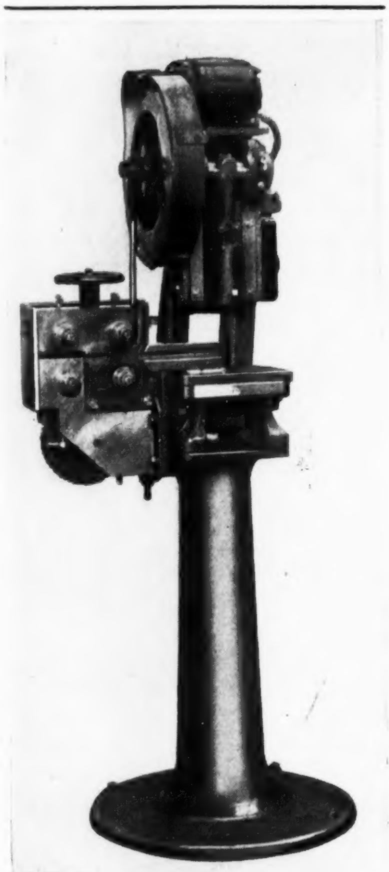
Since the guiding finger is mounted on the rocking member, there is no danger of its losing contact with the flute. This feature permits the cutting edges of the mill to be backed off accurately and uniformly at a single pass. The guiding finger is adjustable for all sizes of straight-shank end-mills from 1/4 inch to 2 inches in diameter. Extra bushings can be supplied for handling tapered-shank mills.



Delta Pedestal Type Grinder for General-purpose Service

Bliss Automatic High-Speed Press

The self-contained high-speed automatic press here illustrated is one of the smallest power-driven machines built by the E. W. Bliss Co., 1420 Hastings St., Toledo, Ohio. The machine is mounted on a pedestal for accessibility and to save floor space. The press is completely self-contained; it is direct-geared to a 1/2-horsepower motor which drives the flywheel at a speed that gives 700 ram strokes a minute.



Self-contained Automatic High-speed Press

Automatic operation is obtained by means of a special roll-feed mounted on the left-hand end of the bolster. The feeding mechanism of the rolls is actuated by a bellcrank on the flywheel end of the shaft. A screw adjustment on the bellcrank permits varying the feed from 0 to 1 inch. A handwheel is provided, by means of which positive adjustment of the tandem roller mechanism is effected.

The feed-rolls are not shown in the illustration; they are normally attached to the four studs that are on the side of the feeding mechanism.

Delta General-Purpose Grinders

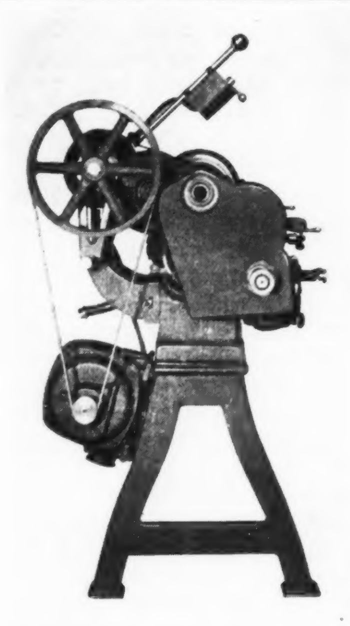
A new line of 7-inch general-purpose grinders has been developed by the Delta Mfg. Co., 627 E. Vienna Ave., Milwaukee, Wis. This line includes three models as follows: A pedestal model for general repair shop, tool-room, and school shop use, which is available with either a single- or a three-phase motor; a bench model with a single-phase motor; and a belt-driven model intended for use in localities where the voltage and phase of the available electric current is not standard and where it is more convenient to drive the machine by belt from an existing motor or lineshaft.

One of the unusual features of the new grinders is the "Twin-Lite Safety Shield," which not only protects the operator's eyes from flying particles of abrasive, but also provides a lighting system. Each shield is equipped for a lamp bulb on each side of the safety glass. These lamps, while casting no glare in the operator's eyes, serve to illuminate both the sides and the face of the grinding wheel. As the lamps are connected to the motor switch, they are only on while the grinder is in actual use.

Sebastian Motor Drive Attachment for Cone-Head Lathes

An attachment that can be applied to any make of cone-head countershaft lathe to convert it into a motor-driven unit has been brought out by the Sebastian Lathe Co., Cincinnati, Ohio. This attachment is made in three sizes for 8- to 12-inch, 13- to 16-inch, and 17- to 20-inch lathes.

Reversing motors having a speed of 1200 revolutions per



End View of Sebastian Motor Drive Attached to Lathe

minute are supplied in 1/2, 1, and 2 horsepower sizes for these attachments. The attachment is provided with a lever for releasing the adjustable spring tension to permit shifting the belt on the cone pulleys. There is a control switch on the tension-releasing lever. The motor can be mounted on the lathe leg or on the floor.

Westinghouse Direct-Current Welder

A Flexarc direct-current welder has recently been brought out by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., for general welding service or production work with bare, dust-coated, or heavy-coated electrodes. One of the important features of this machine is a single dial control, with which the welding current can be set to the number of amperes required. This provision enables the operator to maintain a constant arc in spite of changes in the speed of the driving motor caused by line fluctuations.

The open-circuit voltage, which is well below hazardous values, provides safety for the operator, and yet retains the desirable arc characteristics usually associated with high open-circuit voltage. The welder adjusts itself immediately to the required preset value the moment the arc is struck. This feature facilitates the production of uniform welds on both thick and thin gage metals.

Accessories such as meters, exciter, rheostat, reactor, field discharge resister, starter holding coil, and the conventional underframe have all been eliminated. It is claimed that a considerable reduction in current consumption is obtained by the elimination of the exciter.

The 220-volt sets may be reconnected for 440 volts and the

Westinghouse Arc Welder Designed for Economical Operation

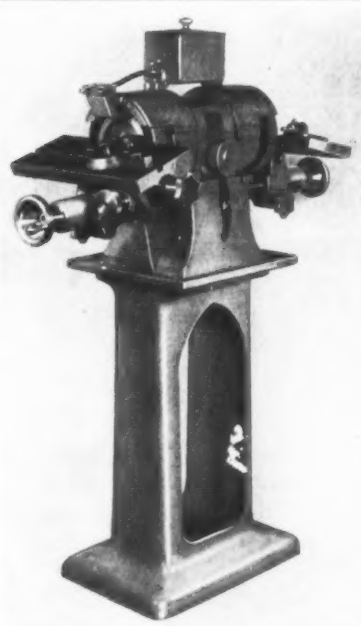
440-volt sets may be reconnected for 220 volts at the conduit box and by changing heaters on the circuit-breaker. A "Nofuse" circuit-breaker for motor operation, mounted within the welder frame, provides circuit protection with no fuses to blow out or coils to burn up. Weatherproof construction is provided by the enclosed armored frame.

Diamond-Wheel Grinder for Carbide Tools

A diamond-wheel grinding machine of the construction here shown has recently been brought out by the Carbide Engineering Co., 439 E. Fort St., Detroit, Mich., for sharpening tungsten-carbide tools. This equipment differs from the previous model in that the tables are fed in and out by turning handwheels. The handwheels are graduated to facilitate table settings to within 0.001 inch. Both tables can be tilted for grinding tools to angles, graduations in degrees being provided.

Ordinary abrasive wheels, as well as diamond wheels, can be used. For diamond wheels, a patented lubricating system is supplied to reduce friction between the diamond wheel and carbide-tipped tools. The builder of the machine recommends the use of oil in this system. The system includes a soft felt oil-retaining pad which is held against the face of the diamond wheel at all times. This pad not only oils the wheel, but also keeps it wiped clean, so that the wheel does not load and glaze.

The motor is of the double-end type, is reversible, and is equipped with preloaded, adjustable ball bearings. Either a 6- or a 7-inch diamond wheel and an 8-inch abrasive wheel are standard equipment. The machine is available in plain and universal models.

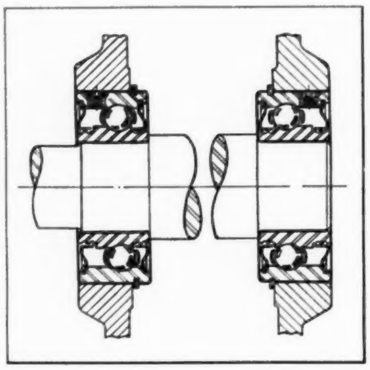


Carbide-tool Sharpening Machine Equipped with a Diamond Wheel

Norma-Hoffmann Cartridge Type Ball Bearing

A completely enclosed, cartridge type precision ball bearing designated as the "3000 Series" is being added to the line of precision bearings made by the Norma-Hoffmann Bearings Corporation, Stamford, Conn. Although this new bearing has but one row of balls, the inner and outer rings are of standard double-row width. The bearing is protected on both sides by metal seals which are free from rubbing friction and wear, yet form a permanent seal against the escape of lubricant. These seals can be easily removed to permit inspecting or cleaning the bearing. The bearing is a complete self-protected unit.

The wide inner and outer rings provide sufficient grease-holding capacity for long periods of continuous operation. The large contact area of the rings also prevents looseness or "peening" on either the shaft or housing. These bearings can be furnished with or without the snap-ring on the outer race. A plug for the renewal of grease can be provided as shown, if desired. Greasing can also be effected by removing and replacing one of the seals. Bearings of this type are made chiefly in the medium size series starting with a bore of 25 millimeters (0.9842 inch).



Norma-Hoffmann Cartridge Type Ball Bearing

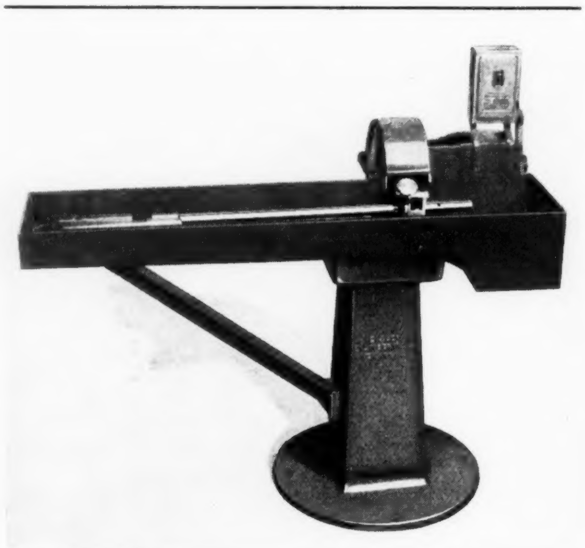
Eisler Wet Abrasive-Disk Cutting-Off Machine

An abrasive type cutting-off machine designed for cutting bars, rods, or tubes of glass, ceramics, metals, and other materials up to 2 1/2 inches in diameter, is being introduced on the market by the Eisler Engineering Co., 769 S. 13th St., Newark, N. J. The thin abrasive disk is driven by a 3/4-horsepower motor at a speed of 5500 surface feet a minute for cutting stock within a few seconds. The wheel revolves in a tank that is filled with water to a point above the cutting level. A quick-acting clamp and long trough facilitate holding and handling the material.

In operation, the rod to be cut is first brought against a stop to locate it for cutting the proper length. The clamping jaw is then closed around the rod to hold it securely while the rod is fed against the revolving abrasive wheel under water. Owing to the fact that the operation takes place under water, dust is eliminated and the burning of material avoided. Also, a slower wheel speed can be used, with a resulting increase in wheel life. Other advantages derived from the use of water are the possibility of cutting a wide range of materials and of obtaining smoothly cut ends of stock.

Sjogren Speed Chuck

A collet chuck that can be opened or closed very quickly by a slight turn of a handwheel has been brought out by the Sjogren Mfg. Co., 1637 E. Slauson Ave., Los Angeles, Calif. This chuck is mounted on a lathe spindle in the same manner as an ordinary three- or four-jaw chuck. It is made in two sizes having capacities for holding work up to



Eisler Abrasive-disk Cutting-off Machine for Glass, Metals, and other Materials

Sjogren Collet Chuck with Handwheel for Quick Opening and Closing

1 inch and 1 3/4 inches in diameter.

The smaller chuck has a 9-inch handwheel, and the larger size is equipped with a 10-inch handwheel. Collets of any size from 1/16 to 1 3/8 inches can be supplied. The collets can be changed in a few seconds. By simply placing the hand on the handwheel and reversing the machine, the collet is instantly released, permitting another collet to be slipped in place.

Federal "Clear Vision" Dial Comparator

The Federal Products Corporation, 1144 Eddy St., Providence, R. I., has recently brought out the Model 110 "Clear Vision" dial comparator here shown. This comparator uses the Model 95 indicator described in November MACHINERY, page 231. The dial is graduated to 0.00005 inch, the distance between graduations being 0.1175 inch so that close readings can be made with ease.

The indicator is raised and lowered by turning the right-hand knob, and it is clamped in position by turning the left-hand knob. The lower anvil is raised and lowered by means of a threaded ring which seats on ball bearings, a micrometer anvil adjustment thus being provided. The anvil illustrated is regular equipment, but special types can be supplied.

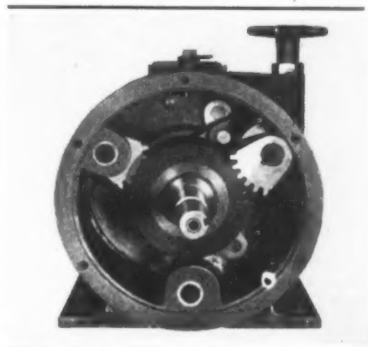
"Clear Vision" Dial Comparator Graduated to 0.00005 Inch

Atkins Hole Saw with Replaceable Blade

One of the features of a hole saw recently designed by E. C. Atkins & Co., 402 S. Illinois St., Indianapolis, Ind., is that the circular saw blade is instantly replaceable in its holder. This design eliminates the necessity of discarding the holder when only the blade is worn out. Holes or plugs of any diameter from 7/8 inch to 4 1/8 inches can be cut with this saw in wood, laminated veneer, metal sheets, pipe, Bakelite, and other materials. The saw can be used either on a portable drill or in a drilling machine, and it is applicable on flat or curved surfaces.

Hole Saw with Replaceable Blade

The holder or head is made in two styles—the No. 4, which is designed to use a 1/4-inch center drill as a hole guide, and the No. 5 which is intended for use with a drill jig. Both holders are fitted with a clamp wedge and a lock-nut. There are two types of spindles available, a No. 2, which is 1/2 inch in diameter, and a No. 3 which is 1/4 inch in diameter. The alloy steel blades used with this saw are made with fourteen teeth to the inch.



Transmission with Cover Removed to Show All Moving Parts

Lenney Variable-Speed Transmission

A variable-speed transmission designed for use between prime movers and machines where a low variable speed is necessary or desirable has been developed by the Lenney Machine & Mfg. Co., Warren, Ohio. The speed of the output shaft of this transmission is infinitely adjustable to a fraction of a revolution per minute at any time, either before starting or while running, by simply turning the speed control handwheel. The running speed is shown by an indicator at the top of the unit which permits setting the drive for any predetermined speed within the range.

All moving parts of the transmission run in oil and are equipped with ball or roller bearings or hardened and ground steel bushings. The range of speed when the input shaft is driven at 1200 revolutions per minute is from 0 to 150 revolutions per minute for the output shaft. With the input shaft driven at 1750 revolutions per minute, the speed of the output shaft can be varied from 0 to 200 revolutions per minute.

This transmission is designed on the simple over-running clutch principle employed by this company for the last four years. It is adapted for driving conveyors, continuous furnaces, electric welders, and a great variety of machines requiring variable speed control. A feature of this transmission is that it can be arranged to have the output shaft run in either direction.

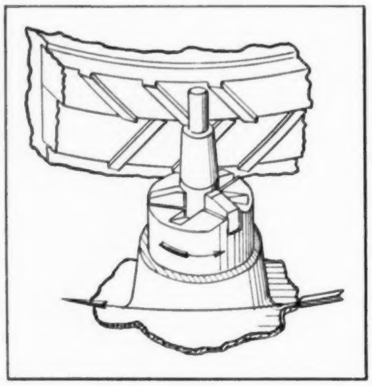


Diagram of Roto-Broach for Finishing Pistons

Bullard Roto-Broaches for Circular Surfaces

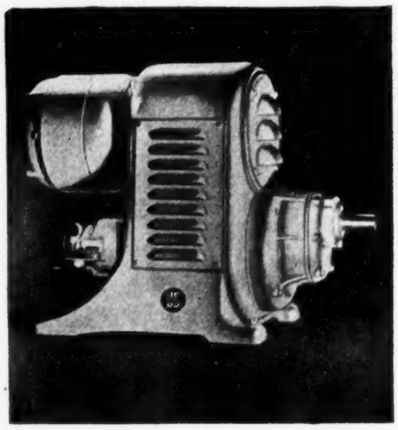
Tools that rough and finish internal and external circular surfaces in one revolution of the tool are being placed on the market by the Bullard Co., Bridgeport, Conn. In operation, the tools, known as Roto-Broaches, revolve in the opposite direction to the work, and are adapted for use in any machine in which both work and cutters rotate.

The cutter blades of the Roto-Broaches are positioned at an angle to the axis of the cutters, so that shearing cuts are taken. In some instances, the tools may be so designed that the cutter blades will cut tangentially to the periphery of the work. In other cases, a circular series of blades may completely surround a piece of work that is to be broached externally. Internal surfaces are, of course, broached by a circular tool that is inserted in the work. Each succeeding blade of a tool is higher than the preceding one, as on conventional types of broaches. As many blades as desired may be assigned to take roughing cuts, and the remainder to take finishing cuts.

Surfaces of several diameters can be broached simultaneously with these tools, as well as tapers, bevels, fillets, etc. The important advantages claimed for Roto-Broaches are that they permit the economical removal of a large amount of metal within a short time; that they possess a long life without regrinding; and that they facilitate the attaining of smooth surface finishes to accurate dimensions. Parts are roughed and finished with one chucking of the work.

Varidrive Unit of Upright Design

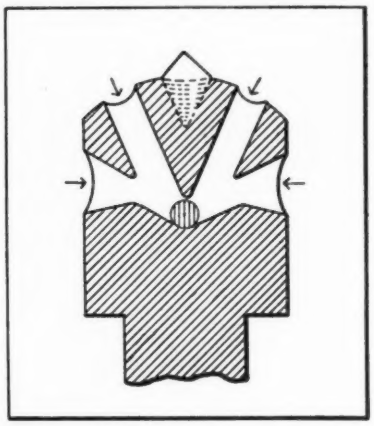
An upright style recently added to the line of Varidrive motor transmission units made by U. S. Electrical Motors, Inc., 200 E. Slauson Ave., Los Angeles, Calif., is here illustrated. The primary advantage of the upright design is a saving in lateral space. However, the design also gives the user the option of having the take-off shaft located in either a high or a low position. The horizontal Varidrive design built by the concern is intended for use when the overhead space is limited.



Varidrive Motor Designed to Save Lateral Space

"Sta-Kool" Holder for Truing Diamonds

A water-cooled holder for truing diamonds, known as the "Sta-Kool," has been developed by J. K. Smit & Sons, Inc., 157 Chambers St., New York City. This holder is so designed that the stream of cooling water directed on the diamond is also carried by channels into the holder immediately in back of the diamond, thus prolonging the effective life of the diamond. The series of channels, as shown in the illustration, are spaced at certain angles relative to the position of the diamond in the holder.

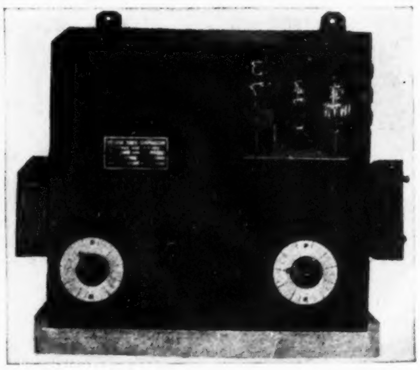


Cross-section of "Sta-Kool" Diamond-holder

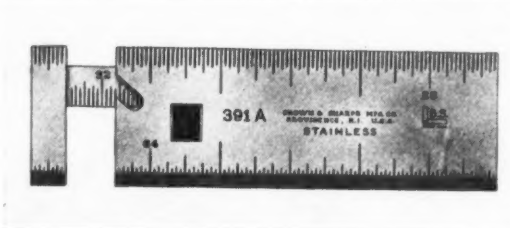
This holder has the advantage, in dry grinding, that cooling air circulates through the same channels as the water in wet grinding.

Welco Electro-Mechanical Welding Timer

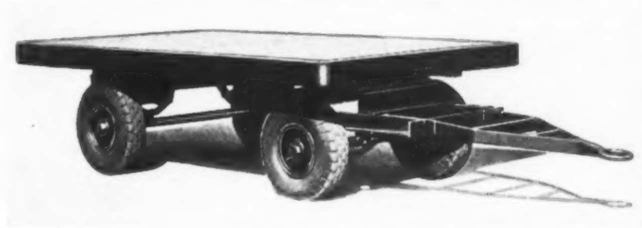
A line of electro-mechanical timers for spot-welding machines is being placed on the market by the Welding Timer Corporation, 251 Ogden St., Newark, N. J. Each device consists of an electronic timing element and a set of balanced contactors especially designed to handle the high



Welco Timer for Spot-welding Machines



Brown & Sharpe Caliper Rule which is Made of Stainless Steel



Mercury Industrial Trailer of Spring-suspended Pneumatic-tired Type

overloads encountered in spot-welding.

These Welco timers permit spot-welding to be performed in periods as low as 1 cycle, and a timing accuracy of less than 1/4 cycle, plus or minus, is guaranteed at a one-cycle operation. At slower speeds, as, for example, between 20 and 30 cycles, it is claimed that accuracy can be insured up to 2 per cent, plus or minus. Standard settings cover a range from a minimum of 1 cycle to a maximum of 30 cycles. Dial settings permit an infinite variation of the time between maximum and minimum.

These timers are made in standard sizes for 30, 50, 150, 250, and 600 amperes; however, larger sizes can be supplied.

B & S Stainless Steel Caliper Rule

The Brown & Sharpe Mfg. Co., Providence, R. I., has recently included in its line the caliper rule No. 391A here illustrated. This rule is made of stainless steel, which provides a lasting fine finish and insures clean, easily read graduations.

This stainless steel caliper rule is made only in a 3-inch length. The first corner is graduated in eighths of an inch; the second, in sixteenth of an inch; the third, in thirty-seconds of an inch; and the fourth, in sixty-fourths of an inch. The slide is graduated in thirty-seconds and sixty-fourths of an inch.

Mercury Trailer with Pneumatic Rubber Tires

A spring-suspended pneumatic-tired trailer of the fifth-wheel steering type, recently brought out by the Mercury Mfg. Co., 4118 S. Halsted St., Chicago, Ill., is shown in the accompanying illustration. This trailer has a capacity of 4000 pounds. The deck, which is 26 1/2 inches high when unloaded, is made of kiln-dried hard wood, set in a heavy T-iron frame, 60 inches wide and 108 inches long. The frame is reinforced with heavy Z-iron longitudinal sills and structural cross-members.

The springs are of the automotive semi-elliptic type. They are mounted on one solid and one sliding shackle and adapt the trailer for hauling over rough runways or for handling fragile material. Timken roller bearings are used, and the trailer is equipped with Alemite-Zerk fittings for lubrication purposes.

R & L Turning Tool

One of the principal advantages claimed for a combination tool being introduced on the market by R & L Tools, Nicetown, Philadelphia, Pa., is the provision of a back-rest having faces of tantalum carbide. The extremely hard surface of the tantalum carbide makes it impossible to pick up metal chips which might mar the surface of the work. The back-rest actually serves as a burnisher to produce a highly polished surface on parts being turned.

At the left in the illustration, the tool is shown arranged for

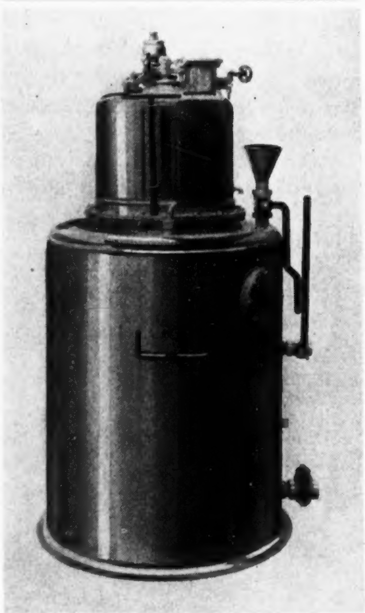
Three Methods of Using the R & L Turning Tool

both drilling and turning in one operation. The back-rest is seen in back and above the drill, while the turning tool is shown in front and below the drill. The back-rest can be adjusted to precede or follow the turning tool, or to be directly in line with it. A floating construction allows the drill to be centered accurately, regardless of discrepancies in the machine.

In the central view of the illustration the back-rest and tool are shown positioned for right-hand turning. The same combination tool can be used for left-hand turning by making the required adjustments. The right-hand view of the illustration shows how two turning tools can be used on opposite sides of a piece for cutting to two different diameters.

Linde Medium-Pressure Acetylene Generator

A small-size medium-pressure acetylene generator for portable or stationary service has just been brought out by the Linde Air Products Co., 30 E. 42nd St., New York City. This generator is known as the Oxweld Type MP-6 medium-pressure generator. It has a 50-pound carbide capacity with a double rating of 100 cubic feet of acetylene per hour. The dome may be tilted to give access to the interior.

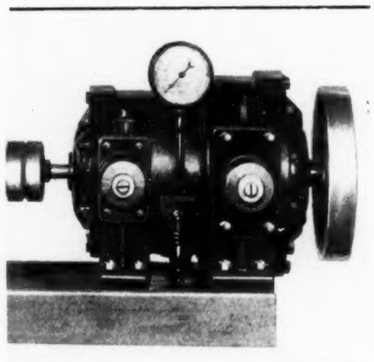


Acetylene Generator for Pressures up to 14 Pounds per Square Inch

This generator is adapted for use with any type of oxy-acetylene cutting or welding apparatus. A handwheel at the generator top makes it possible to control the carbide feed so that acetylene at any desired pressure up to 14 pounds per square inch may be obtained.

Variable-Speed Hydraulic Transmission

A line of variable-speed high-pressure hydraulic transmissions comprising a variable-displacement pump and a variable-displacement motor, joined end to end, both units having exactly the same design and flow characteristics, has been announced by the General Hydraulic Co., Bucyrus, Ohio. This equipment is being manufactured by the Ohio Locomotive Crane Co. of the same city. The units are hydrostatically balanced and are equipped with anti-friction devices to insure high operating efficiency.



Variable-speed Transmission Brought out by the General Hydraulic Co.

The piston, cylinder and valve pintle assembly have been specially designed to resist wear. The wear-resistant Nitralloy parts are claimed to function positively at all operating temperatures.

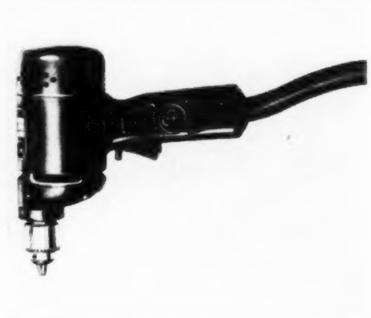


Fig. 1. Heavy-duty 3/16-inch Electric Drill Made by Chicago Pneumatic Tool Co.

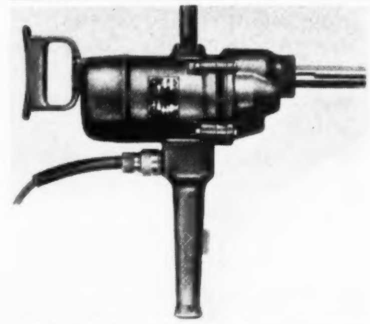


Fig. 2. Heavy-duty Electric Drill for Drilling up to 1-inch Holes

C. P. Universal Portable Electric Drills

A line of universal portable electric drills in eight sizes, ranging in drilling capacities from 3/16 to 1 inch inclusive, has been announced by the Chicago Pneumatic Tool Co., 6 E. 44th St., New York City. These tools are available in standard-duty and heavy-duty models, with a wide range of spindle speeds. They are regularly made for operation on 110- and 220-volt circuits. They can also be furnished for 32- and 250-volt circuits on special order.

The high-torque motors used in these drills are cooled by a new "Straight-line Airflow" ventilation system. Helical gearing is employed on the armature to obtain strength and quiet operation. The ball bearings are mounted in steel inserts, which are cast integral with the bearing housings.

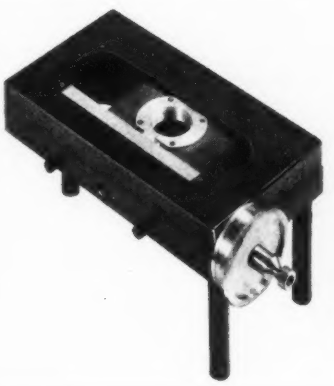


Fig. 1. Slide Designed for Use in Combination with a Microscope

New Products for Precision Measurement

Three new precision measuring devices developed by the Mann Instrument Co., 10 Arrow St., Cambridge, Mass., include optical flats, the ball-bearing slide illustrated in Fig. 1, and the precision square shown in Fig. 2. The optical flats are 4 inches in diameter by 3/4 inch thick and are available in plate glass or Pyrex. Flats are carried in stock accurate within 1/10 of a wave length of green light, but flats can be supplied with a greater degree of flatness if desired. These optical flats are intended for use in the shop, toolroom, laboratory, and classroom.

The ball-bearing slide, shown in Fig. 1, is intended for use in making measurements by means of a microscope actuated by a precision screw. The device consists of a normalized cast-iron base provided with hardened steel ways. Between the ways is a hardened steel carriage which can be moved back and forth by turning the precision screw.

The carriage has an adapter into which a standard microscope can be screwed. However, the adapter can be removed and a stage mounted on the slide for viewing objects under a fixed microscope that is mounted separately. The carriage moves between ball bearings which have been slightly preloaded so that the carriage can be used in any required position. At the end of the screw is a dial graduated to represent 0.01 millimeter of slide travel, and a millimeter scale is attached to the cover; this facilitates accurate setting.

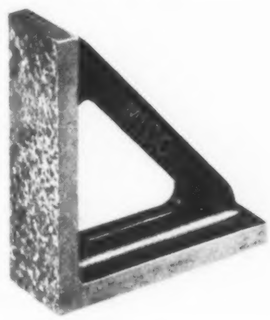
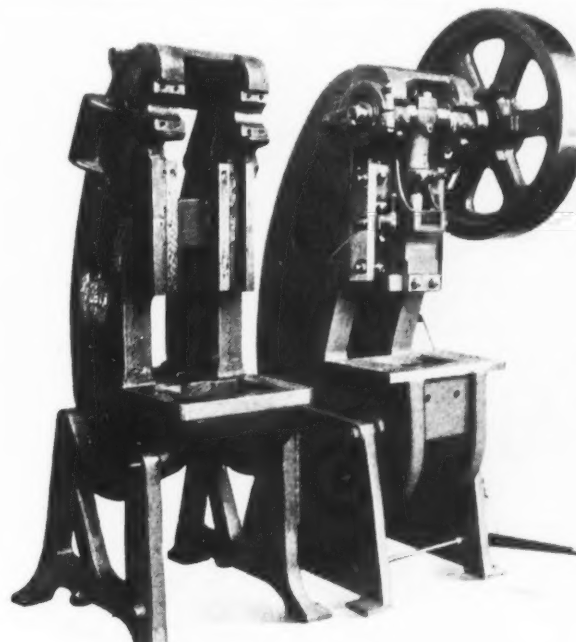


Fig. 2. Precision Square Made by the Mann Instrument Co.

Tapped holes are provided in the base of this device, so that it can be used with a surface plate, precision square, etc. The three legs are removable.

The precision square, shown in Fig. 2, is made of cast iron and normalized between machining operations to relieve internal stresses. Each face of the square measures 4 1/2 by 1 1/2 inches. The faces are scraped until the included angle is 90 degrees within 0.0001 inch in 4 1/2 inches.

Broken Cast-iron Frame (Left) of an Old Power Press which was Replaced by a Frame of Welded Steel Construction (Right). The Working Parts of the Original Press have been Mounted on the Welded Frame, which is of Box Section. The Welded Frame was Fabricated by the Quickwork Co., St. Marys, O.



NEWS OF THE INDUSTRY

California

Dr. William Frederick Durand has been awarded the John Fritz gold medal for 1936 for notable achievements "in hydro-dynamic and aero-dynamic science and its practical application, and as an outstanding leader in research and in engineering education." Dr. Durand is a past-president of the American Society of Mechanical Engineers and professor-emeritus of mechanical engineering of Stanford University of California. He has received many honors in the past for his achievements in science and engineering.

Metalspray Co., Inc., 113 Llewellyn St., Los Angeles, Calif., has succeeded the company formerly known as the Metal Spray Co., of the same city, which latter company has manufactured and distributed Metalspray guns and equipment for the last five years. J. C. Martin, Jr., has been elected president. Mr. Martin, for many years, has acted as consulting engineer and patent counsel for several major industries. H. B. Rice is vice-president and secretary. He has been connected with the metal spray industry for the last five years and was for many years district manager for the Oxweld Acetylene Co.

George E. Clifford has been appointed district sales manager of the Republic Steel Corporation in the Los Angeles, Calif., district, succeeding George F. Emanuels.

Illinois

Ingersoll Milling Machine Co., Rockford, Ill., announces that the sale of Ingersoll cutters is now being handled in the Philadelphia area, eastern Pennsylvania, southern New Jersey, Delaware, Maryland, and Virginia by the Wright & Gade Equipment Co., 3701 N. Broad St., Philadelphia, Pa. The company also announces the appointment of O. A. Muenz, 50 Church St., New York City, as representative for metropolitan New York, southeastern New York, southwestern Connecticut, and northern New Jersey.

W. H. Gibb has resigned as vice-president of the Thomson-Gibb Electric Welding Co., Lynn, Mass., but expects to continue on the board of directors of that company. He has incorporated the firm of Gibb-Lewis Co., 231 S. LaSalle St., Chicago, Ill., for the purpose of dealing in patents and patented articles. The new firm already numbers among its clients many of the large manufacturing companies of the country, who will thus be placed in contact with new developments in their industries.

Photo Walinger

W. H. Gibb, Head of the Newly Organized Firm of Gibb-Lewis Co.

Millers Falls Co., Greenfield, Mass., has moved its Chicago office from 9 S. Clinton St. to 100 S. Jefferson St. The office continues under the management of Harry Duncan.

Udylite Co., Detroit, Mich., announces the opening of a Chicago warehouse at 1943 Walnut St., Chicago, Ill., where complete stocks of electroplating and polishing equipment and supplies will be carried for immediate delivery.

Michigan

C. E. McArthur has been elected general sales manager of the Western Machine Tool Works, Holland, Mich., manufacturers of Western radial drills, Garvin automatic tappers, Steptoe shapers, and Chard lathes. Mr. McArthur was formerly secretary and sales manager of the Modern Tool Co. of Erie, Pa., and later was with the Consolidated Machine Tool Corporation of America at Rochester, N. Y., after the Modern Tool Co. was merged with that corporation.

Michigan Tool Co., Detroit, Mich., has recently let contracts for the erection of a new plant adjacent to its present factory on McNichols Road. The new building will add about 20,000 square feet to the present facilities of the company.

Frank De Witt & Co., 5736 Twelfth St., Detroit, Mich., has been appointed representative of the Kennedy Valve Mfg. Co., Elmira, N. Y., in the lower peninsula in the state of Michigan, including the city of Detroit.

Michigan Tool Co., Detroit, Mich., has assigned to the Dominion Engineering Works, Ltd., of Montreal, Canada, the Canadian manufacturing and distribution rights for Cone area-contact worm-gearing.

New Jersey

Worthington Pump & Machinery Corporation, Harrison, N. J., announces that the corporation has developed a term-payment purchase plan to enable purchasers of its products to take advantage of the provisions of the National Housing Act as amended for industry. It is not generally understood by users of industrial equipment that this Act has been amended to enable them to purchase needed equipment. A pamphlet is published by the company giving complete details.

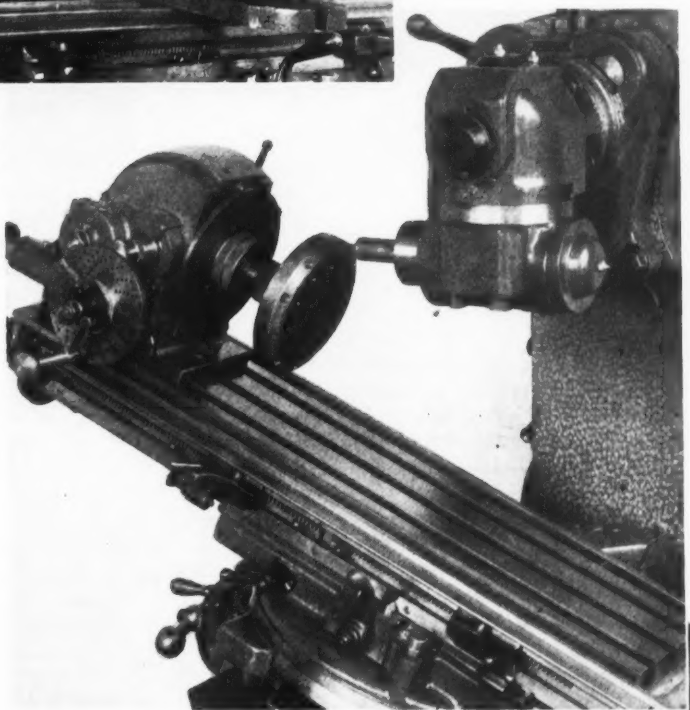
Thomas W. Delanty has been appointed manager of eastern railroad sales for Joseph T. Ryerson & Son, Inc., Chicago, Ill. Mr. Delanty has been with the Ryerson company since 1918, and has been in the railroad sales division since 1925. He has had considerable

Thomas W. Delanty, Manager of Eastern Railroad Sales, Joseph T. Ryerson & Son

UNIQUE

. . . in providing an easy and accurate method of obtaining both ***simple*** *and* ***compound*** *angular settings for Milling or Boring Operations . .*

Note widened sphere of Usefulness through the Universal Milling Attachment with Crane



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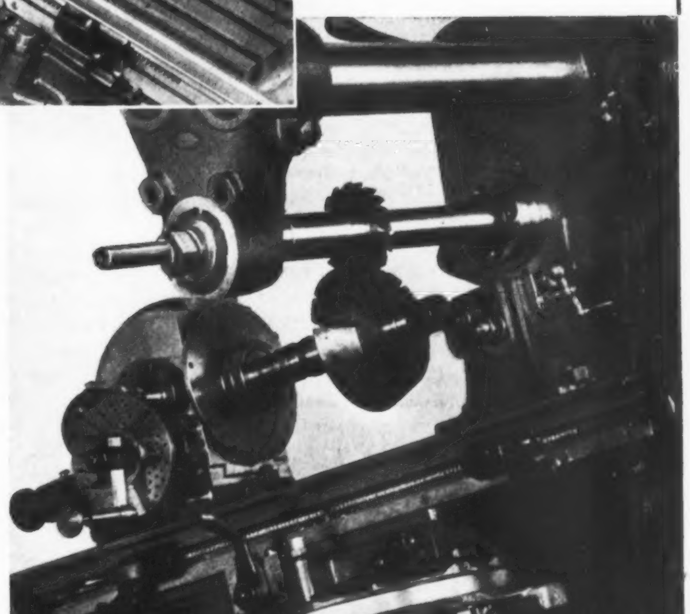

The New

BROWN & SHARPE OMNIVERSAL MILLING MACHINE

New in Design . . . with Unusual Advantages for the Toolroom . . . . and for the Manufacturing Floor as well. May we send details?

Brown & Sharpe Mfg. Co.
Providence, R. I., U. S. A.

experience in the machinery division. Shortly after the earthquake in China (1923), he was sent to Japan, China, and Manchuria, and until 1925 he handled the export business there for the machinery division. His headquarters will be at the Ryerson Jersey City plant.

New York

CHARLES F. SCOTT, professor-emeritus of electrical engineering, Yale University, was elected chairman of the Engineers' Council for Professional Development at the third annual meeting held in New York on October 8. Professor Scott succeeds C. H. HIRSHFELD, chief of research of the Detroit Edison Co., who has served as chairman of the Council since its formation.

OAKITE PRODUCTS, INC., 26 Thames St., New York City, will hold its annual technical sales conference December 9 to 13 at the New York headquarters, which will be attended by nearly one hundred field service representatives of the company. A large number of technical papers will be read, dealing with the cleaning problems of many different industries.

ERIE FOUNDRY CO., Erie, Pa., manufacturer of steam hammers, board drop-hammers and trimming presses, announces the appointment of the SYRACUSE SUPPLY CO. as its representative in the territories covered by the following offices: 314 W. Fayette St., Syracuse, N. Y.; Lincoln Alliance Bank Bldg., Rochester, N. Y., and 296 Delaware Ave., Buffalo, N. Y.

J. S. VANICK, of the development and research department of the International Nickel Co., Inc., 67 Wall St., New York City, addressed the Toledo Chapter of the American Society for Metals on October 28. Mr. Vanick's subject was "Short Sketches of Recent Progress in Cast Iron."

HERSCHEL V. BEASLEY has joined the technical staff of the International Nickel Co., Inc., 67 Wall St., New York City. His activities will include problems involving the production and application of alloy cast irons. He will make his headquarters in the New York office.

WORTHINGTON PUMP & MACHINERY CORPORATION, Harrison, N. J., is constructing an additional machine shop building at its Buffalo Works which will cover a floor area of 75,000 square feet. It is expected that the building will be ready for occupancy about the first of the year.

UDYLITE CO., Detroit, Mich., has appointed the SCOBELL CHEMICAL CO., Rochester, N. Y., distributor for the complete line of plating and polishing supplies and equipment made by this concern.

Ohio

LAKESIDE WELDING CO., 3005 E. 55th St., Cleveland, Ohio, has been organized by John G. Lincoln and Homer Meanor to conduct a commercial welding shop. Both Mr. Lincoln and Mr. Meanor have had wide experience in welding and re-design work. Mr. Lincoln, who is the son of John C. Lincoln, chairman of the board of the Lincoln Electric Co., spent a number of years in the research and development work of that concern. Mr. Meanor, who was also with the Lincoln Electric Co., developed designs for welding in the engineering department. Prior to the formation of the new company he was connected with the Contract Welding Co. of Cleveland.

LINCOLN ELECTRIC CO., Cleveland Ohio, announces the addition of a number of men to their sales personnel and the opening of new offices at Peoria, Ill., and Memphis, Tenn. The Peoria office is located at 923 S. Washington St., and is under the direction of W. I. MISKOE, formerly of the Chicago sales office. The Memphis office is under the direction of O. B. FARRELL.

LEW HINCHMAN has been transferred to the Chicago district sales office located at 1455 W. 37th St. PAUL M. CORP has joined the Milwaukee office of the company. E. H. WEIL has been added to the San Francisco sales personnel.

PAUL R. JOHNSTON has been made district sales manager for the Republic Steel Corporation in the Cincinnati, Ohio, territory, succeeding ROBERT J. WORKING, recently appointed district sales manager at Birmingham, Ala.

REYNOLDS MACHINERY CO., machinery merchants, announce the removal of their office to larger and more convenient quarters in the Plymouth Bldg., Cleveland, Ohio.

Pennsylvania

E. F. HOUGHTON & CO., 240 W. Somerset St., Philadelphia, Pa., has recently made an addition to its Philadelphia plant in the form of new executive offices and increased storage and shipping space to meet the needs of increasing business. The company also announces that the Canadian subsidiary, E. F. Houghton & Co. of Canada, Ltd., located in Toronto, has grown to such an extent that it has been necessary to increase its manufacturing capacity.

JESSOP STEEL CO., Washington, Pa., announces that, under a license agreement with the CLEVELAND TWIST DRILL CO., Cleveland, Ohio, holder of a patent covering Mo-Max type of molybdenum high-speed steel, the Jessop Steel Co. has been authorized to produce the same type of steel under the trade name of Mogul.

OBITUARIES

William C. Read

William Carlton Read, for twenty-five years associated in an official capacity with the metallurgical research and development activities of the Union Carbide & Carbon Corporation, of New York,

William C. Read

died suddenly on November 6 at his home in New Rochelle, N. Y., aged forty-seven years.

Mr. Read was born in Taunton, Mass. He graduated from the Massachusetts Institute of Technology in 1909, and in 1910 became associated with the Union Carbide Co. at Niagara Falls, N. Y. Several years later he was transferred to the Saulte Ste. Marie, Mich., plant. In 1917, he returned to the Niagara Falls plants of this company and of the Electro Metallurgical Co., where he remained until 1928, when he was transferred to the works manager's department in the general offices of these companies in New York.

Arthur A. Shafer

Arthur A. Shafer, until recently secretary of the Rickert-Shafer Co., Erie, Pa., died at his home on November 5. Death was caused by an acute attack of bronchial asthma. He was stricken while at his office and lived only a short while after being removed to his home.

Mr. Shafer, after graduation from the Central High School of Erie, Pa., started his business career in the engineering department of the Modern Tool Co., Erie,

Thank You!

1935 A BIGGER AND BETTER YEAR

Herman L. Krouse
FORT WAYNE

C. E. Crandall
NEW YORK

D. J. Wheeler
DETROIT

Lon Sloan
CHICAGO

J. A. Gilroy
LOUISVILLE

M. R. Hoff
BUFFALO

R. J. Koch
ITHACA

P. T. Stevenson
PITTSBURGH

Fred M. Potgieter
CHICAGO

W. F. Weston
CINCINNATI

Charles L. Pratt Jr.
BOSTON

Quintin J. Kearney
PHILADELPHIA

Thos. M. Manley
ITHACA

C. A. Shetter
CLEVELAND

George E. Olmstead
NEW YORK

F. Ganderson
BOSTON

W. W. Bertram
ITHACA

Carl C. Moss
CHICAGO

Joseph A. Meary
PHILADELPHIA

H. E. Lunn Jr.
NEW YORK

It's been a great year for Morse. Thousands of customers, both new and old, have given Morse a generous share of their business during 1935. Throughout industry there has been a definite upturn in business—plants are being modernized, definite savings are being made in production costs and Morse is endeavoring to meet these demands through careful, considerate service to industry.

Morse is also keeping pace with modernization with new equipment at both Ithaca and Detroit plants. These increased facilities assure Morse customers of better service in manufacturing and delivery.

Morse takes this opportunity to thank industry for making 1935 a bigger and better year, and also to show its appreciation of the sincere and earnest efforts of these Morse men in the field. With thorough knowledge and experience in transmission of power, they are always ready to serve industry with better methods of power transmission.

MORSE

Silent and Roller Chains and Sprockets
Flexible Couplings and Clutches

Morse Magic Silent Chain Drive Selector automatically selects the proper drive, checks and designs chain drives, saves time. Send for one. It's free.

Morse 1936 Calendars are now ready. Ask for your copy.

MORSE CHAIN CO., ITHACA, N. Y.
Division of Borg-Warner Corporation

Pa. Later he became associated with the engineering department of the Cleveland Automatic Machine Co., which position he left to join the Rickert-Shafer Co. when it was organized in 1914. He served as secretary and manager of this company until May, 1935. At the time of his death he was with the engineering department of the Hookless Fastener Co., Meadville, Pa.

Mr. Shafer's wide circle of friends and business associates will be greatly grieved to learn of his sudden death.

HENRY S. HAMPSON, for fifteen years associated with the sales organization of the Electro Metallurgical Sales Corporation of New York, died suddenly on November 13 at his home in New Rochelle, N. Y., aged forty-two years. Mr. Hampson was born in Waterbury, Conn. He attended Lafayette University before entering business. Following a general business experience, he became associated with the Electro Metallurgical Sales Corporation in August, 1920, as a sales representative in the New York office. Subsequently he was transferred to the Pittsburgh office of the company, later returning to New York.

ROBERT CHELSTROM, New England representative of Oster-Williams, Cleveland, Ohio, was killed in an automobile accident on October 18 while returning to his home in Boston from a trip to Connecticut. He was fifty-nine years of age. Mr. Chelstrom joined the sales organization of the Oster Mfg. Co. in 1924, and when this organization was merged with the Williams Tool Corporation in 1929, he continued as New England representative. He had a host of friends and will be missed greatly by all who knew him.

ALVA L. EVANS, Philadelphia branch manager of the Warner & Swasey Co., Cleveland, Ohio, died on November 3.

NEW BOOKS

MACRAE'S BLUE BOOK (1935-1936). 3380 pages, 8 1/2 by 11 1/4 inches. Published by MacRae's Blue Book Co., 18 E. Huron St., Chicago, Ill. Price, $15.

This is the forty-third annual edition of a directory covering all the manufactured products in the United States. The book gives the information required in locating manufacturers, securing quotations, making purchases, and compiling lists for sales purposes. Thus it is a valuable aid both to buyers and sellers. It contains a complete list of manufacturers of every product used in industry, arranged alphabetically and also classified by products. The Classified Material section alone covers 2227 pages. The alphabetical list gives, in addition, the location of branch offices and distributors. A separate section contains a list of trade names. There is also a Trade Facilities section containing local and shipping information for any city or town in the United States with a population of 1000 or more. Following the population figures, the name of the leading bank, with name of cashier; leading commercial organizations, with name of secretary; and all railroads and warehouses are given.

APPRENTICE TRAINING. By L. Q. Moss. 9 pages, 8 1/2 by 11 1/2 inches. Distributed by the Philadelphia Navy Yard Apprentice Association, Philadelphia, Pa. Price, 15 cents.

This pamphlet contains a reprint of an article on apprentice training, published in a recent number of the *Marine Engineering & Shipping Age*, describing the system of training apprentices employed at the Philadelphia Navy Yard.

COMING EVENTS

DECEMBER 2-6—Annual meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS at the Engineering Societies' Building, 29 W. 39th St., New York City. C. E. Davies, secretary, 29 W. 39th St., New York City.

DECEMBER 2-7—FIFTEENTH EXPOSITION OF THE CHEMICAL INDUSTRIES at the Grand Central Palace, New York City. Charles F. Roth, manager, Grand Central Palace, New York.

JANUARY 13-17 — Annual meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Book-Cadillac Hotel, Detroit, Mich. John A. C. Warner, secretary and general manager, 29 W. 39th St., New York City.

MARCH 10-14 — SIXTH PACKAGING EXPOSITION, held under the auspices of the American Management Association at the Hotel Pennsylvania, New York City. Roberts Everett Associates, Inc., 232 Madison Ave., New York City, are the managers of the Exposition.

APRIL 20-25 — SEVENTH ANNUAL OIL EQUIPMENT AND ENGINEERING EXPOSITION, to be held in Convention Hall, Houston, Tex. E. G. Lenzner, general manager, P. O. Box 490, Houston, Tex.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, ETC., REQUIRED BY THE ACT OF CONGRESS OF MARCH 3, 1933,

of MACHINERY, published monthly at New York, N. Y., for October 1, 1935.

State of New York }
County of New York } ss.

Before me, a Notary Public, in and for the state and county aforesaid, personally appeared Edgar A. Becker, who having been duly sworn according to law, deposes and says that he is the treasurer of The Industrial Press, Publishers of MACHINERY, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of March 3, 1933, embodied in section 537, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, The Industrial Press, 140-148 Lafayette St., New York; Editor, Erik Oberg, 140-148 Lafayette St.. New York; Managing Editor, None; Business Managers, Robert B. Luchars, 140-148 Lafayette St., New York; Edgar A. Becker, 140-148 Lafayette St., New York; and Erik Oberg, 140-148 Lafayette St., New York.

2. That the owners of 1 per cent or more of the total amount of stock are: The Industrial Press, 140-148 Lafayette St., New York; Louis Pelletier, 140-148 Lafayette St., New York; Erik Oberg, 140-148 Lafayette St., New York; Robert B. Luchars, 140-148 Lafayette St., New York; Edgar A. Becker, 140-148 Lafayette St., New York; Laura A. Brownell, 140-148 Lafayette St., New York; Franklin D. Jones, 140-148 Lafayette St., New York; Elizabeth Y. Urban, 163 Western Drive, Longmeadow, Mass.; and Helen L. Ketchum, Atlantic Ave., Cohasset, Mass.

3. That there are no bondholders, mortgagees, or other security holders.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company, but also, in cases where the stockholder, or security holder, appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

EDGAR A. BECKER, Treasurer

Sworn to and subscribed before me this 23rd day of September, 1935

CHARLES P. ABEL,
Notary Public, Kings County No. 250
(SEAL) Kings Register No. 7079
New York County No. 155. New York Register No. 7-A-69
(My commission expires March 30, 1937)